# Rules Governing Public Drinking Water Systems

## PART 2 - DESIGN, CONSTRUCTION AND OPERATION OF WATER SYSTEM FACILITIES

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- Visit the Division of Drinking Water's web site, drinkingwater.utah.gov, for current information on all Drinking Water Board rules. The web site has electronic copies of the rules which may be viewed, downloaded or searched.

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# R309-110 Definitions (Effective December 9, 2002)

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# R309-110. Administration: Definitions.

## *R309-110-1. Purpose.*

The purpose of this rule is to define certain terms and expressions that are utilized throughout all rules under R309. Collectively, those rules govern the administration, monitoring, operation and maintenance of public drinking water systems as well as the design and construction of facilities within said systems.

## *R309-110-2. Authority.*

This rule is promulgated by the Drinking Water Board as authorized by Title 19, Environmental Quality Code, Chapter 4, Safe Drinking Water Act, Subsection 104 of the Utah Code and in accordance with 63-46a of the same, known as the Administrative Rulemaking Act.

## *R309-110-3. Acronyms.*

As used in R309:

**"AF"** means Acre Foot.

**"AWOP"** means Area Wide Optimization Program.

**"AWWA"** means American Water Works Association.

**"BAT"** means Best Available Technology.

**"C"** means Residual Disinfectant Concentration.

**"CCP**" means Composite Correction Program.

**"CCR"** means Consumer Confidence Report.

**"CEU"** means Continuing Education Unit.

**"CFE"** means Combined Filter Effluent.

**"cfs"** means Cubic Feet Per Second.

**"CPE"** means Comprehensive Performance Evaluation.

**"CT"** means Residual Concentration multiplied by Contact Time.

**"CTA"** means Comprehensive Technical Assistance.

**"CWS"** means Community Water System.

**"DBPs"** means Disinfection Byproducts.

**"DE"** means Diatomaceous Earth.

**"DWSP"** means Drinking Water Source Protection.

**"EP"** means Entry Point.

**"ERC"** means Equivalent Residential Connection.

**"FBRR"** means Filter Backwash Recycling Rule.

**"fps"** means Feet Per Second

**"gpd"** means Gallons Per Day.

**"gpm"** means Gallons Per Minute.

**"gpm/sf"** means Gallons Per Minute Per Square Foot.

**"GWR"** means Ground Water Rule.

**"GWUDI"** means Ground Water Under Direct Influence of Surface Water.

**"HAA5s"** means Haloacetic Acids (Five).

**"HPC"** means Heterotrophic Plate Count.

**"ICR"** means Information Collection Rule of 40 CRF 141 subpart M.

**"IESWTR"** means Interim Enhanced Surface Water Treatment Rule.

**"IFE"** means Individual Filter Effluent.

**"LT1ESWTR"** means Long Term 1 Enhanced Surface Water Treatment Rule.

**"LT2ESWTR"** means Long Term 2 Enhanced Surface Water Treatment Rule.

**"MCL"** means Maximum Contaminant Level.

**"MCLG"** means Maximum Contaminant Level Goal.

**"MDBP"** means Microbial-Disinfection Byproducts.

**"MG"** means Million Gallons.

**"MGD"** means Million Gallons Per Day.

**"mg/L"** means Milligrams Per Liter

**"MRDL"** means Maximum Residual Disinfectant Level.

**"MRDLG"** means Maximum Residual Disinfectant Level Goal.

"**NCWS"** means Non-Community Water System.

**"NTNC"** means Non-Transient Non-Community.

**"NTU"** means Nephelometric Turbidity Unit.

**"PN"** means Public Notification.

**"PWS"** means Public Water System.

**"SDWA"** means Safe Drinking Water Act.

**"Stage 1 DBPR"** means Stage 1 Disinfectants and Disinfection Byproducts Rule.

"**Stage 2 DBPR"** means Stage 2 Disinfectants and Disinfection Byproducts Rule.

**"Subpart H"** means A PWS using SW or GWUDI.

**"Subpart P"** means A PWS using SW or GWUDI and serving at least 10,000 people.

"**Subpart S"** means Provisions of 40 CRF 141 subpart S commonly referred to as the Information Collection Rule.

**"Subpart T"** means A PWS using SW or GWUDI and serving less than 10,000 people.

**"SUVA"** means Specific Ultraviolet Absorption.

**"SW"** means Surface Water.

**"SWAP"** means Source Water Assessment Program.

"**SWTR"** means Surface Water Treatment Rule.

**"T"** means Contact Time.

**"TA"** means Technical Assistance.

**"TCR"** means Total Coliform Rule.

**"TNCWS"** means Transient Non-Community Water System.

**"TNTC"** means Too Numerous To Count.

**"TOC"** means Total Organic Carbon.

**"TT"** means Treatment Technique.

**"TTHM"** means Total Trihalomethanes.

**"WCP"** means Watershed Control Program.

"**WHP"** means Wellhead Protection.

## *R309-110-4. Definitions.*

As used in R309:

**"Action Level"** means the concentration of lead or copper in drinking water tap samples (0.015 mg/l for lead and 1.3 mg/l for copper) which determines, in some cases, the corrosion treatment, public education and lead line replacement requirements that a water system is required to complete.

**"AF"** means acre foot and is the volume of water required to cover an acre to a depth of one foot (one AF is equivalent to 325,851 gallons).

**"Air gap"** The unobstructed vertical distance through the free atmosphere between the lowest opening from any pipe or faucet supplying water to a tank, catch basin, plumbing fixture or other device and the flood level rim of the receptacle. This distance shall be two times the diameter of the effective opening for openings greater than one inch in diameter where walls or obstructions are spaced from the nearest inside edge of the pipe opening a distance greater than three times the diameter of the effective openings for a single wall, or a distance greater than four times the diameter of the effective opening for two intersecting walls. This distance shall be three times the diameter of the effective opening where walls or obstructions are closer than the distances indicated above.

**"ANSI/NSF"** refers to the American National Standards Institute and NSF International. NSF International has prepared at least two health effect standards dealing with treatment chemicals added to drinking water and system components that will come into contact with drinking water, these being Standard 60 and Standard 61. The American National Standards Institute acts as a certifying agency, and determines which laboratories may certify to these standards.

**"Approval"** unless indicated otherwise, shall be taken to mean a written statement of acceptance from the Executive Secretary.

**"Approved"** refers to a rating placed on a system by the Division and means that the public water system is operating in substantial compliance with all the Rules of R309.

**"Average Yearly Demand"** means the amount of water delivered to consumers by a public water system during a typical year, generally expressed in MG or AF.

**"AWWA"** refers to the American Water Works Association located at 6666 West Quincy Avenue, Denver, Colorado 80235. Reference within these rules is generally to a particular Standard prepared by AWWA and which has completed the ANSI approval process such as ANSI/AWWA Standard C651-92 (AWWA Standard for Disinfecting Water Mains).

**"Backflow"** means the undesirable reversal of flow of water or mixtures of water and other liquids, gases, or other substances into the distribution pipes of the potable water supply from any source. Also see backsiphonage, backpressure and cross-connection.

**"Backpressure"** means the phenomena that occurs when the customer's pressure is higher than the supply pressure. This could be caused by an unprotected cross-connection between a drinking water supply and a pressurized irrigation system, a boiler, a pressurized industrial process, elevation differences, air or steam pressure, use of booster pumps or any other source of pressure. Also see backflow, backsiphonage and cross-connection.

**"Backsiphonage"** means a form of backflow due to a reduction in system pressure which causes a subatomospheric or negative pressure to exist at a site or point in the water system. Also see backflow and cross-connection.

**"Best Available Technology"** (BAT) means the best technology, treatment techniques, or other means which the Executive Secretary finds, after examination under field conditions and not solely under laboratory conditions, are available (taking cost into consideration). For the purposes of setting MCLs for synthetic organic chemicals, any BAT must be at least as effective as granular activated carbon for all these chemicals except vinyl chloride. Central treatment using packed tower aeration is also identified as BAT for synthetic organic chemicals.

**"Board"** means the Drinking Water Board.

**"Breakpoint Chlorination"** means addition of chlorine to water until the chlorine demand has been satisfied. At this point, further addition of chlorine will result in a free residual chlorine that is directly proportional to the amount of chlorine added beyond the breakpoint.

**"C"** is short for "Residual Disinfectant Concentration."

**"Capacity Development"** means technical, managerial, and financial capabilities of the water system to plan for, achieve, and maintain compliance with applicable drinking water standards.

**"cfs"** means cubic feet per second and is one way of expressing flowrate (one cfs is equivalent to 448.8 gpm).

**"Class"** means the level of certification of Backflow Prevention Technician (Class I, II or III).

**"Coagulation"** is the process of destabilization of the charge (predominantly negative) on particulates and colloids suspended in water. Destabilization lessens the repelling character of particulates and colloids and allows them to become attached to other particles so that they may be removed in subsequent processes. The particulates in raw waters (which contribute to color and turbidity) are mainly clays, silt, viruses, bacteria, fulvic and humic acids, minerals (including asbestos, silicates, silica, and radioactive particles), and organic particulate.

**"Collection area"** means the area surrounding a ground-water source which is underlain by collection pipes, tile, tunnels, infiltration boxes, or other ground-water collection devices.

**"Commission"** means the Operator Certification Commission.

**"Community Water System"** (CWS) means a public water system which serves at least 15 service connections used by year-round residents or regularly serves at least 25 year-round residents.

**"Compliance cycle"** means the nine-year calendar year cycle during which public water systems must monitor. Each compliance cycle consists of three three-year compliance periods. The first calendar year cycle began January 1, 1993 and ends December 31, 2001; the second begins January 1, 2002 and ends December 31, 2010; the third begins January 1, 2011 and ends December 31, 2019.

**"Compliance period"** means a three-year calendar year period within a compliance cycle. Each compliance cycle has three three-year compliance periods. Within the first compliance cycle, the first compliance period ran from January 1, 1993 to December 31,

1995; the second from January 1, 1996 to December 31, 1998; and the third is from January 1, 1999 to December 31, 2001.

"**Comprehensive Performance Evaluation"** (CPE) is a thorough review and analysis of a treatment plant's performance-based capabilities and associated administrative, operation and maintenance practices. It is conducted to identify factors that may be adversely impacting a plant's capability to achieve compliance and emphasizes approaches that can be implemented without significant capital improvements. For purposes of compliance with these rules, the comprehensive performance evaluation must consist of at least the following components: Assessment of plant performance; evaluation of major unit processes; identification and prioritization of performance limiting factors; assessment of the applicability of comprehensive technical assistance; and preparation of a CPE report.

**"Confirmed SOC contamination area"** means an area surrounding and including a plume of SOC contamination of the soil or water which previous monitoring results have confirmed. The area boundaries may be determined by measuring 3,000 feet horizontally from the outermost edges of the confirmed plume. The area includes deeper aquifers even though only the shallow aquifer is the one contaminated.

"**Confluent growth"** means a continuous bacterial growth covering the entire filtration area of a membrane filter, or a portion of the filtration area in which discrete bacterial colonies can not be distinguished.

**"Contaminant"** means any physical, chemical biological, or radiological substance or matter in water.

**"Continuing Education Unit"** (CEU) means ten contact hours of participation in, and successful completion of, an organized and approved continuing education experience under responsible sponsorship, capable direction, and qualified instruction. College credit in approved courses may be substituted for CEUs on an equivalency basis.

**"Conventional Surface Water Treatment"** means a series of processes including coagulation, flocculation, sedimentation, filtration and disinfection resulting in substantial particulate removal and inactivation of pathogens.

**"Controls"** means any codes, ordinances, rules, and regulations that a public water system can cite as currently in effect to regulate potential contamination sources; any physical conditions which may prevent contaminants from migrating off of a site and into surface or ground water; and any site with negligible quantities of contaminants.

**"Corrective Action"** refers to a rating placed on a system by the Division and means a provisional rating for a public water system not in compliance with the Rules of R309, but making all the necessary changes outlined by the Executive Secretary to bring them into compliance.

**"Corrosion inhibitor"** means a substance capable of reducing the corrosiveness of water toward metal plumbing materials, especially lead and copper, by forming a protective film on the interior surface of those materials.

**"Credit Enhancement Agreement"** means any agreement entered into between the Board, on behalf of the State, and an eligible water system for the purpose of providing methods and assistance to eligible water systems to improve the security for and marketability of drinking water project obligations.

**"Criteria"** means the conceptual standards that form the basis for DWSP area delineation to include distance, ground-water time of travel, aquifer boundaries, and ground-water divides.

**"Criteria threshold"** means a value or set of values selected to represent the limits above or below which a given criterion will cease to provide the desired degree of protection.

**"Cross-Connection"** means any actual or potential connection between a drinking (potable) water system and any other source or system through which it is possible to introduce into the public drinking water system any used water, industrial fluid, gas or substance other than the intended potable water. For example, if you have a pump moving non-potable water and hook into the drinking water system to supply water for the pump seal, a cross-connection or mixing may lead to contamination of the drinking water. Also see backsiphonage, backpressure and backflow.

**"Cross Connection Control Program"** means the program administered by the public water system in which cross connections are either eliminated or controlled.

**"Cross Connection Control Commission"** means the duly constituted advisory subcommittee appointed by the Board to advise the Board on Backflow Technician Certification and the Cross Connection Control Program of Utah.

**"CT or $CT_{calc}$"** is the product of "residual disinfectant concentration" (C) in mg/l determined before or at the first customer, and the corresponding "disinfectant contact time" (T) in minutes, i.e., "C" x "T." If a public water system applies disinfectant at more than one point prior to the first customer, the summation of each CT value for each disinfectant sequence before or at the first customer determines the total percent inactivation or "Total Inactivation Ratio." In determining the Total Inactivation Ratio, the public water system must determine the residual disinfectant concentration of each disinfection sequence and corresponding contact time before any subsequent disinfection application point(s).

**"CTreq'd"** is the CT value required when the log reduction credit given the filter is subtracted from the (3-log) inactivation requirement for Giardia lamblia or the (4-log) inactivation requirement for viruses.

**"CT99.9"** is the CT value required for 99.9 percent (3-log) inactivation of Giardia lamblia cysts. $CT_{99.9}$ for a variety of disinfectants and conditions appear in Tables 1.1-1.6, 2.1, and 3.1 of Section 141.74(b)(3) in the code of Federal Regulations (also available from the Division).

**"Designated person"** means the person appointed by a public water system to ensure that the requirements of their Drinking Water Source Protection Plan(s) for ground water sources and/or surface water sources are met.

**"Direct Employment"** means that the operator is directly compensated by the drinking water system to operate that drinking water system.

**"Direct Filtration"** means a series of processes including coagulation and filtration, but excluding sedimentation, resulting in substantial particulate removal.

**"Direct Responsible Charge"** means active on-site control and management of routine maintenance and operation duties. A person in direct responsible charge is generally an operator of a water treatment plant or distribution system who independently makes decisions during normal operation which can affect the sanitary quality, safety, and adequacy of water delivered to customers. In cases where only one operator is employed by the system, this operator shall be considered to be in direct responsible charge.

**"Disadvantaged Communities"** are defined as those communities located in an area which has a median adjusted gross income which is less than or equal to 80% of the State's median adjusted gross income, as determined by the Utah State Tax commission from federal individual income tax returns excluding zero exemptions returns.

**"Discipline"** means type of certification (Distribution or Treatment).

**"Disinfectant Contact Time"** ("T" in CT calculations) means the time in minutes that it takes water to move from the point of disinfectant application or the previous point of disinfectant residual measurement to a point before or at the point where residual disinfectant concentration ("C") is measured. Where only one "C" is measured, "T" is the time in minutes that it takes water to move from the point of disinfectant application to a point before or at where residual disinfectant concentration ("C") is measured. Where more than one "C" is measured, "T" is (a) for the first measurement of "C," the time in minutes that it takes water to move from the first or only point of disinfectant application to a point before or at the point where the first "C" is measured and (b) for subsequent measurements of "C," the time in minutes that it takes for water to move from the previous "C" measurement point to the "C" measurement point for which the particular "T" is being calculated. Disinfectant contact time in pipelines must be calculated by dividing the internal volume of the pipe by the maximum hourly flow rate through that pipe. Disinfectant contact time within mixing basins and storage reservoirs must be determined by tracer studies or an equivalent demonstration.

**"Disinfection"** means a process which inactivates pathogenic organisms in water by chemical oxidants or equivalent agents (see also Primary Disinfection and Secondary Disinfection).

**"Disinfection profile"** is a summary of daily Giardia lamblia inactivation through the treatment plant.

**"Distribution System"** means the use of any spring or well source, distribution pipelines, appurtenances, and facilities which carry water for potable use to consumers through a public water supply. Systems which chlorinate groundwater are in this discipline.

**"Distribution System Manager"** means the individual responsible for all operations of a distribution system.

**"Division"** means the Utah Division of Drinking Water, who acts as staff to the Board and is also part of the Utah Department of Environmental Quality.

**"Dose Equivalent"** means the product of the absorbed dose from ionizing radiation and such factors as account for differences in biological effectiveness due to the type of radiation and its distribution in the body as specified by the International Commission of Radiological Units and Measurements (ICRU).

**"Drinking Water"** means water that is fit for human consumption and meets the quality standards of R309-200. Common usage of terms such as culinary water, potable water or finished water are synonymous with drinking water.

**"Drinking Water Project"** means any work or facility necessary or desirable to provide water for human consumption and other domestic uses which has at least fifteen service connections or serves an average of twenty-five individuals daily for at least sixty days of the year and includes collection, treatment, storage, and distribution facilities under the control of the operator and used primarily with the system and collection, pretreatment or storage facilities used primarily in connection with the system but not under such control.

**"Drinking Water Project Obligation"** means any bond, note or other obligation issued to finance all or part of the cost of acquiring, constructing, expanding, upgrading or improving a drinking water project.

**"Drinking Water Regional Planning"** means a county wide water plan, administered locally by a coordinator, who facilitates the input of representatives of each public water system in the county with a selected consultant, to determine how each public water system will either collectively or individually comply with source protection, operator certification, monitoring (including consumer confidence reports), capacity development (including technical, financial and managerial aspects), environmental issues, available funding and related studies.

**"DWSP Program"** means the program to protect drinking water source protection zones and management areas from contaminants that may have an adverse effect on the health of persons.

**"DWSP Zone"** means the surface and subsurface area surrounding a ground-water or surface water source of drinking water supplying a PWS, over which or through which contaminants are reasonably likely to move toward and reach such water source.

**"Emergency Storage"** means that storage tank volume which provides water during emergency situations, such as pipeline failures, major trunk main failures, equipment failures, electrical power outages, water treatment facility failures, source water supply contamination, or natural disasters.

**"Engineer"** means a person licensed under the Professional Engineers and Land Surveyors Licensing Act, 58-22 of the Utah Code, as a "professional engineer" as defined therein.

**"Enhanced coagulation"** means the addition of sufficient coagulant for improved removal of disinfection byproduct precursors by conventional filtration treatment.

**"Enhanced softening"** means the improved removal of disinfection byproduct precursors by precipitative softening.

**"Equalization Storage"** means that storage tank volume which stores water during periods of low demand and releases the water under periods of high demand. Equalization storage provides a buffer between the sources and distribution for the varying daily water demands. Typically, water demands are high in the early morning or evening and relatively low in the middle of the night. A rule-of-thumb for equalization storage volume is that it should be equal to one average day's use.

**"Equivalent Residential Connection"** (ERC) is a term used to evaluate service connections to consumers other than the typical residential domicile. Public water system management is expected to review annual metered drinking water volumes delivered to non-residential connections and estimate the equivalent number of residential connections that these represent based upon the average of annual metered drinking water volumes delivered to true single family residential connections. This information is utilized in evaluation of the system's source and storage capacities (refer to R309-510).

**"Executive Secretary"** means the Executive Secretary of the Board as appointed and with authority outlined in 19-4-106 of the Utah Code.

**"Existing ground-water source of drinking water"** means a public supply ground-water source for which plans and specifications were submitted to the Division on or before July 26, 1993.

**"Existing surface water source of drinking water"** means a public supply surface water source for which plans and specifications were submitted to the Division on or before June 12, 2000.

**"Filtration"** means a process for removing particulate matter from water by passage through porous media.

**"Filter profile"** is a graphical representation of individual filter performance, based on continuous turbidity measurements or total particle counts verus time for an entire filter run, from startup to backwash inclusively, that includes an assessment of filter performance while another filter is being backwashed.

**"Financial Assistance"** means a drinking water project loan, credit enhancement agreement, interest buy-down agreement or hardship grant.

**"Fire Suppression Storage"** means that storage tank volume allocated to fire suppression activities. It is generally determined by the requirements of the local fire marshal, expressed in gallons, and determined by the product of a minimum flowrate in gpm and required time expressed in minutes.

**"First draw sample"** means a one-liter sample of tap water, collected in accordance with an approved lead and copper sampling site plan, that has been standing in plumbing pipes at least 6 hours and is collected without flushing the tap.

**"Flash Mix"** is the physical process of blending or dispersing a chemical additive into an unblended stream. Flash Mixing is used where an additive needs to be dispersed rapidly (within a period of one to ten seconds). Common usage of terms such as "rapid mix" or "initial mix" are synonymous with flash mix.

**"Floc"** means flocculated particles or agglomerated particles formed during the flocculation process. Flocculation enhances the agglomeration of destabilized particles and colloids toward settleable (or filterable) particles (flocs). Flocculated particles may be small (less than 0.1 mm diameter) micro flocs or large, visible flocs (0.1 to 3.0 mm diameter).

**"Flocculation"** means a process to enhance agglomeration of destabilized particles and colloids toward settleable (or filterable) particles (flocs). Flocculation begins immediately after destabilization in the zone of decaying mixing energy (downstream from the mixer) or as a result of the turbulence of transporting flow. Such incidental flocculation may be an adequate flocculation process in some instances. Normally flocculation involves an intentional and defined process of gentle stirring to enhance contact of destabilized particles and to build floc particles of optimum size, density, and strength to be subsequently removed by settling or filtration.

**"fps"** means feet per second and is one way of expressing the velocity of water.

**"G"** is used to express the energy required for mixing and for flocculation. It is a term which is used to compare velocity gradients or the relative number of contacts per unit volume per second made by suspended particles during the flocculation process. Velocity gradients G may be calculated from the following equation: G = square root of the value(550 times P divided by u times V). Where: P = applied horsepower, u = viscosity, and V = effective volume.

**"GAC10"** means granular activated carbon filter beds with an empty-bed contact time of 10 minutes based on average daily flow and a carbon reactivation frequency of every 180 days.

**"Geometric Mean"** the geometric mean of a set of N numbers $X_1$, $X_2$, $X_3$,....., $X_N$ is the Nth root of the product of the numbers.

**"gpd"** means gallons per day and is one way of expressing average daily water demands experienced by public water systems.

**"gpm"** means gallons per minute and is one way of expressing flowrate.

**"gpm/sf"** means gallons per minute per square foot and is one way of expressing flowrate through a surface area.

**"Grade"** means any one of four possible steps within a certification discipline of either water distribution or water treatment. Grade I indicates knowledge and experience requirements for the smallest type of public water supply. Grade IV indicates knowledge and experience levels appropriate for the largest, most complex type of public water supply.

**"Gross Alpha Particle Activity"** means the total radioactivity due to alpha particle emission as inferred from measurements on a dry sample.

**"Gross Beta Particle Activity"** means the total radioactivity due to beta particle emission as inferred from measurements on a dry sample.

**"ground water of high quality"** means a well or spring producing water deemed by the Executive Secretary to be of sufficiently high quality that no treatment is required. Such sources shall have been designed and constructed in conformance with these rules, have been tested to establish that all applicable drinking water quality standards (as given in rule R309-200) are reliably and consistently met, have been deemed not vulnerable to natural or man-caused contamination, and the public water system management have established adequate protection zones and management policies in accordance with rule R309-600.

**"ground water of low quality"** means a well or spring which, as determined by the Executive Secretary, cannot reliably and consistently meet the drinking water quality standards described in R309-200. Such sources shall be deemed to be a low quality

ground water source if any of the conditions outlined in subsection R309-505-8(1) exist. Ground water that is classified "UDI" is a subset of this definition and requires "conventional surface water treatment" or an acceptable alternative.

**"Ground Water Source"** means any well, spring, tunnel, adit, or other underground opening from or through which ground water flows or is pumped from subsurface water-bearing formations.

**"Ground Water Under the Direct Influence of Surface Water"** or "UDI" means any water beneath the surface of the ground with significant occurrence of insects or other macro organisms, algae, or large-diameter pathogens such as Giardia lamblia, or (for surface water treatment systems serving at least 10,000 people only) Cryptosporidium, or significant and relatively rapid shifts in water characteristics such as turbidity, temperature, conductivity, or pH which closely correlate to climatological or surface water conditions. Direct influence will be determined for individual sources in accordance with criteria established by the Executive Secretary. The determination of direct influence may be based on site-specific measurements of water quality and/or documentation of well or spring construction and geology with field evaluation.

**"Haloacetic acids (five)"** (HAA5) mean the sum of the concentrations in mg/L of the haloacetic acid compounds (monochloroacetic acid, dichloroacetic acid, trichloroacetic acid, monobromoacetic acid, and dibromoacetic acid), rounded to two significant figures after addition.

**"Hardship Grant"** means a grant of monies to a political subdivision that meets the drinking water project loan considerations whose project is determined by the Board to not be economically feasible unless grant assistance is provided. A hardship grant may be authorized in the following forms:

(1) a Planning Advance which will be required to be repaid at a later date, to help meet project costs incident to planning to determine the economic, engineering and financial feasibility of a proposed project;

(2) a Design Advance which will be required to be repaid at a later date, to help meet project costs incident to design including, but not limited to, surveys, preparation of plans, working drawings, specifications, investigations and studies; or

(3) a Project Grant which will not be required to be repaid.

**"Hardship Grant Assessment"** means an assessment applied to loan recipients. The assessment shall be calculated as a percentage of principal. Hardship grant assessment funds shall be subject to the requirements of UAC R309-700 for hardship grants.

**"Hotel, Motel or Resort"** shall include tourist courts, motor hotels, resort camps, hostels, lodges, dormitories and similar facilities, and shall mean every building, or

structure with all buildings and facilities in connection, kept, used, maintained as, advertised as, or held out to the public to be, a place where living accommodations are furnished to transient guests or to groups normally occupying such facilities on a seasonal or short term basis.

**"Hydrogeologic methods"** means the techniques used to translate selected criteria and criteria thresholds into mappable delineation boundaries. These methods include, but are not limited to, arbitrary fixed radii, analytical calculations and models, hydrogeologic mapping, and numerical flow models.

**"Initial compliance period"** means the first full three-year compliance period which begins at least 18 months after promulgation, except for contaminants listed in R309-200-5(3)(a), Table 200-2 numbers 19 to 33; R309-200-5(3)(b), Table 200-3 numbers 19 to 21; and R309-200-5(1)(c), Table 200-1 numbers 1, 5, 8, 11 and 18, initial compliance period means the first full three-year compliance after promulgation for systems with 150 or more service connections (January 1993-December 1995), and first full three-year compliance period after the effective date of the regulation (January 1996-December 1998) for systems having fewer than 150 service connections.

**"Intake",** for the purposes of surface water drinking water source protection, means the device used to divert surface water and also the conveyance to the point immediately preceding treatment, or, if no treatment is provided, at the entry point to the distribution system.

**"Interest Buy-Down Agreement"** means any agreement entered into between the Board, on behalf of the State, and a political subdivision, for the purpose of reducing the cost of financing incurred by a political subdivision on bonds issued by the subdivision for drinking water project costs.

**"Labor Camp"** shall mean one or more buildings, structures, or grounds set aside for use as living quarters for groups of migrant laborers or temporary housing facilities intended to accommodate construction, industrial, mining or demolition workers.

**"Land management strategies"** means zoning and non-zoning controls which include, but are not limited to, the following: zoning and subdivision ordinances, site plan reviews, design and operating standards, source prohibitions, purchase of property and development rights, public education programs, ground water monitoring, household hazardous waste collection programs, water conservation programs, memoranda of understanding, written contracts and agreements, and so forth.

**"Land use agreement"** means a written agreement, memoranda or contract wherein the owner(s) agrees not to locate or allow the location of uncontrolled potential contamination sources or pollution sources within zone one of new wells in protected aquifers or zone one of surface water sources. The owner(s) must also agree not to locate or allow the location of pollution sources within zone two of new wells in unprotected aquifers and new springs unless the pollution source agrees to install design standards

which prevent contaminated discharges to ground water. This restriction must be binding on all heirs, successors, and assigns. Land use agreements must be recorded with the property description in the local county recorder's office. Refer to R309-600-13(2)(d).

Land use agreements for protection areas on publicly owned lands need not be recorded in the local county recorder office. However, a letter must be obtained from the Administrator of the land in question and meet the requirements described above.

**"Large water system"** for the purposes of R309-210-6 only, means a water system that serves more than 50,000 persons.

**"Lead free"** means, for the purposes of R309-210-6, when used with respect to solders and flux refers to solders and flux containing not more than 0.2 percent lead; when used with respect to pipes and pipe fittings refers to pipes and pipe fittings containing not more than 8.0 percent lead; and when used with respect to plumbing fittings and fixtures intended by the manufacturer to dispense water for human ingestion refers to fittings and fixtures that are in compliance with standards established in accordance with 42 U.S.C. 300 g-6(e).

**"Lead service line"** means a service line made of lead which connects the water main to the building inlet and any lead pigtail, gooseneck or other fitting which is connected to such lead line.

**"Legionella"** means a genus of bacteria, some species of which have caused a type of pneumonia called Legionnaires Disease.

**"Major Bacteriological Routine Monitoring Violation"** means that no routine bacteriological sample was taken as required by R309-210-5(1).

**"Major Bacteriological Repeat Monitoring Violation**" - means that no repeat bacteriological sample was taken as required by R309-210-5(2).

**"Major Chemical Monitoring Violation**" - means that no initial background chemical sample was taken as required in R309-204-4(5).

**"Management area"** means the area outside of zone one and within a two-mile radius where the Optional Two-mile Radius Delineation Procedure has been used to identify a protection area.

For wells, land may be excluded from the DWSP management area at locations where it is more than 100 feet lower in elevation than the total drilled depth of the well.

For springs and tunnels, the DWSP management area is all land at elevation equal to or higher than, and within a two-mile radius, of the spring or tunnel collection area. The DWSP management area also includes all land lower in elevation than, and within 100 horizontal feet, of the spring or tunnel collection area. The elevation datum to be used is

the point of water collection. Land may also be excluded from the DWSP management area at locations where it is separated from the ground water source by a surface drainage which is lower in elevation than the spring or tunnel collection area.

**"Man-Made Beta Particle and Photon Emitters**" means all radionuclides emitting beta particles and/or photons listed in Maximum Permissible Body Burdens and maximum Permissible Concentration of Radionuclides in Air or Water for Occupational Exposure, "NBS Handbook 69," except the daughter products of thorium-232, uranium-235 and uranium-238.

**"Maximum Contaminant Level"** (MCL) means the maximum permissible level of a contaminant in water which is delivered to any user of a public water system.

**"Maximum residual disinfectant level"** (MRDL) means a level of a disinfectant added for water treatment that may not be exceeded at the consumer's tap without an unacceptable possibility of adverse health effects. For chlorine and chloramines, a PWS is in compliance with the MRDL when the running annual average of monthly averages of samples taken in the distribution system, computed quarterly, is less than or equal to the MRDL. For chlorine dioxide, a PWS is in compliance with the MRDL when daily samples are taken at the entrance to the distribution system and no two consecutive daily samples exceed the MRDL. MRDLs are enforceable in the same manner as MCLs pursuant to UT Code S 19-4-104 . There is convincing evidence that addition of a disinfectant is necessary for control of waterborne microbial contaminants. Notwithstanding the MRDLs listed in R309-200-5(3), operators may increase residual disinfectant levels of chlorine or chloramines (but not chlorine dioxide) in the distribution system to a level and for a time necessary to protect public health to address specific microbiological contamination problems caused by circumstances such as distribution line breaks, storm runoff events, source water contamination, or cross-connections.

**"Maximum residual disinfectant level goal"** (MRDLG) means the maximum level of a disinfectant added for water treatment at which no known or anticipated adverse effect on the health of persons would occur, and which allows an adequate margin of safety. MRDLGs are non-enforceable health goals and do not reflect the benefit of the addition of the chemical for control of waterborne microbial contaminants.

**"Medium-size water system**" for the purposes of R309-210-6 only, means a water system that serves greater than 3,300 and less than or equal to 50,000 persons.

**"Metropolitan area sources"** means all sources within a metropolitan area. A metropolitan area is further defined to contain at least 3,300 year round residents. A small water system which has sources within a metropolitan system's service area, may have those sources classified as a metropolitan area source.

**"MG"** means million gallons and is one way of expressing a volume of water.

**"MGD"** means million gallons per day and is one way of expressing average daily water demands experienced by public water systems or the capacity of a water treatment plant.

**"mg/L"** means milligrams per liter and is one way of expressing the concentration of a chemical in water. At small concentrations, mg/L is synonymous with "ppm" (parts per million).

**"Minor Bacteriological Routine Monitoring Violation"** means that not all of the routine bacteriological samples were taken as required by R309-210-5(1).

**"Minor Bacteriological Repeat Monitoring Violation"** means that not all of the repeat bacteriological samples were taken as required by R309-210-5(2).

**"Minor Chemical Monitoring Violation"** means that the required chemical sample(s) was not taken in accordance with R309-205 and R309-210.

**"Modern Recreation Camp"** means a campground accessible by any type of vehicular traffic. The camp is used wholly or in part for recreation, training or instruction, social, religious, or physical education activities or whose primary purpose is to provide an outdoor group living experience. The site is equipped with permanent buildings for the purpose of sleeping, a drinking water supply under pressure, food service facilities, and may be operated on a seasonal or short term basis. These types of camps shall include but are not limited to privately owned campgrounds such as youth camps, church camps, boy or girl scout camps, mixed age groups, family group camps, etc.

**"Near the first service connection"** means one of the service connections within the first 20 percent of all service connections that are nearest to the treatment facilities.

**"Negative Interest"** means a loan having loan terms with an interest rate at less than zero percent. The repayment schedule for loans having a negative interest rate will be prepared by the Board.

**"New ground water source of drinking water"** means a public supply ground water source of drinking water for which plans and specifications are submitted to the Division after July 26, 1993.

**"New surface water source of drinking water"** means a public supply surface water source of drinking water for which plans and specifications are submitted to the Division after June 12, 2000.

**"New Water System"** means a system that will become a community water system or non-transient, non-community water system on or after October 1, 1999.

**"Non-Community Water System"** (NCWS) means a public water system that is not a community water system. There are two types of NCWS's: transient and non-transient.

**"Non-distribution system plumbing problem"** means a coliform contamination problem in a public water system with more than one service connection that is limited to the specific service connection from which a coliform-positive sample was taken.

**"Nonpoint source"** means any diffuse source of contaminants or pollutants not otherwise defined as a point source.

**"Non-Transient Non-Community Water System"** (NTNCWS) means a public water system that regularly serves at least 25 of the same nonresident persons per day for more than six months per year. Examples of such systems are those serving the same individuals (industrial workers, school children, church members) by means of a separate system.

**"Not Approved"** refers to a rating placed on a system by the Division and means the water system does not fully comply with all the Rules of R309 as measured by R309-400.

**"NTU"** means Nephelometric Turbidity Units and is an acceptable method for measuring the clarity of water utilizing an electronic nephelometer (see "Standard Methods for Examination of Water and Wastewater").

**"Operator"** means a person who operates, repairs, maintains, and is directly employed by a public drinking water system.

**"Operator Certification Commission"** means the Commission appointed by the Board as an advisory Commission on public water system operator certification.

**"Operating Permit"** means written authorization from the Executive Secretary to actually start utilizing a facility constructed as part of a public water system.

**"Optimal corrosion control treatment"** for the purposes of R309-210-6 only, means the corrosion control treatment that minimizes the lead and copper concentrations at users' taps while insuring that the treatment does not cause the water system to violate any national primary drinking water regulations.

**"Package Plants"** refers to water treatment plants manufactured and supplied generally by one company which are reportedly complete and ready to hook to a raw water supply line. Caution, some plants do not completely comply with all requirements of these rules and will generally require additional equipment.

**"PCBs"** means a group of chemicals that contain polychlorinated biphenyl.

**"Peak Day Demand"** means the amount of water delivered to consumers by a public water system on the day of highest consumption, generally expressed in gpd or MGD. This peak day will likely occur during a particularly hot spell in the summer. In contrast, some systems associated with the skiing industry may experience their "Peak Day Demand" in the winter.

**"Peak Instantaneous Demand"** means calculated or estimated highest flowrate that can be expected through any water mains of the distribution network of a public water system at any instant in time, generally expressed in gpm or cfs (refer to section R309-510-9).

**"Person"** means an individual, corporation, company, association, partnership; municipality; or State, Federal, or tribal agency.

**"Picocurie"** (pCi) means that quantity of radioactive material producing 2.22 nuclear transformations per minute.

**"Plan Approval"** means written approval, by the Executive Secretary, of contract plans and specifications for any public drinking water project which have been submitted for review prior to the start of construction (see also R309-500-7).

**"Plug Flow"** is a term to describe when water flowing through a tank, basin or reactors moves as a plug of water without ever dispersing or mixing with the rest of the water flowing through the tank.

**"Point of Disinfectant Application"** is the point where the disinfectant is applied and water downstream of that point is not subject to re-contamination by surface water runoff.

**"Point of Diversion"(POD)** is the point at which water from a surface source enters a piped conveyance, storage tank, or is otherwise removed from open exposure prior to treatment.

**"Point-of-Entry Treatment Device"** means a treatment device applied to the drinking water entering a house or building for the purpose of reducing contaminants in the drinking water distributed throughout the house or building.

**"Point-of-Use Treatment Device**" means a treatment device applied to a single tap used for the purpose of reducing contaminants in drinking water at that one tap.

**"Point source"** means any discernible, confined, and discrete source of pollutants or contaminants, including but not limited to any site, pipe, ditch, channel, tunnel, conduit, well, discrete fissure, container, rolling stock, animal feeding operation with more than ten animal units, landfill, or vessel or other floating craft, from which pollutants are or may be discharged.

**"Political Subdivision"** means any county, city, town, improvement district, metropolitan water district, water conservancy district, special service district, drainage district, irrigation district, separate legal or administrative entity created under Title 11, Chapter 13, Interlocal Cooperation Act, or any other entity constituting a political subdivision under the laws of Utah.

**"Pollution source"** means point source discharges of contaminants to ground or surface water or potential discharges of the liquid forms of "extremely hazardous substances" which are stored in containers in excess of "applicable threshold planning quantities" as specified in SARA Title III. Examples of possible pollution sources include, but are not limited to, the following: storage facilities that store the liquid forms of extremely hazardous substances, septic tanks, drain fields, class V underground injection wells, landfills, open dumps, landfilling of sludge and septage, manure piles, salt piles, pit privies, drain lines, and animal feeding operations with more than ten animal units.

The following definitions are part of R309-600 and clarify the meaning of "pollution source:"

(1) "Animal feeding operation" means a lot or facility where the following conditions are met: animals have been or will be stabled or confined and fed or maintained for a total of 45 days or more in any 12 month period, and crops, vegetation forage growth, or post-harvest residues are not sustained in the normal growing season over any portion of the lot or facility. Two or more animal feeding operations under common ownership are considered to be a single feeding operation if they adjoin each other, if they use a common area, or if they use a common system for the disposal of wastes.

(2) "Animal unit" means a unit of measurement for any animal feeding operation calculated by adding the following numbers; the number of slaughter and feeder cattle multiplied by 1.0, plus the number of mature dairy cattle multiplied by 1.4, plus the number of swine weighing over 55 pounds multiplied by 0.4, plus the number of sheep multiplied by 0.1, plus the number of horses multiplied by 2.0.

(3) "Extremely hazardous substances" means those substances which are identified in the Sec. 302(EHS) column of the "TITLE III LIST OF LISTS - Consolidated List of Chemicals Subject to Reporting Under SARA Title III," (EPA 550-B-96-015). A copy of this document may be obtained from: NCEPI, PO Box 42419, Cincinnati, OH 45202. Online ordering is also available at http://www.epa.gov/ncepihom/orderpub.html.

**"Potential contamination source"** means any facility or site which employs an activity or procedure which may potentially contaminate ground or surface water. A pollution source is also a potential contamination source.

**"ppm"** means parts per million and is one way of expressing the concentration of a chemical in water. At small concentrations generally used, ppm is synonymous with "mg/l" (milligrams per liter).

**"Practical Quantitation Level"** (PQL) means the required analysis standard for laboratory certification to perform lead and copper analyses. The PQL for lead is .005 milligrams per liter and the PQL for copper is 0.050 milligrams per liter.

**"Primary Disinfection"** means the adding of an acceptable primary disinfectant during the treatment process to provide adequate levels of inactivation of bacteria and pathogens. The effectiveness is measured through "CT" values and the "Total Inactivation Ratio." Acceptable primary disinfectants are, chlorine, ozone, and chlorine dioxide (see also "CT" and "$CT_{99.9}$").

**"Principal Forgiveness"** means a loan wherein a portion of the loan amount is "forgiven" upon closing the loan. The terms for principal forgiveness will be as directed by R309-705-8, and by the Board.

**"Project Costs"** include the cost of acquiring and constructing any drinking water project including, without limitation: the cost of acquisition and construction of any facility or any modification, improvement, or extension of such facility; any cost incident to the acquisition of any necessary property, easement or right of way; engineering or architectural fees, legal fees, fiscal agent's and financial advisors' fees; any cost incurred for any preliminary planning to determine the economic and engineering feasibility of a proposed project; costs of economic investigations and studies, surveys, preparation of designs, plans, working drawings, specifications and the inspection and supervision of the construction of any facility; interest accruing on loans made under this program during acquisition and construction of the project; and any other cost incurred by the political subdivision, the Board or the Department of Environmental Quality, in connection with the issuance of obligation of the political subdivision to evidence any loan made to it under the law.

**"Protected aquifer"** means a producing aquifer in which the following conditions are met:

(1) A naturally protective layer of clay, at least 30 feet in thickness, is present above the aquifer;

(2) the PWS provides data to indicate the lateral continuity of the clay layer to the extent of zone two; and

(3) the public supply well is grouted with a grout seal that extends from the ground surface down to at least 100 feet below the surface, and for a thickness of at least 30 feet through the protective clay layer.

**"Public Drinking Water Project"** means construction, addition to, or modification of any facility of a public water system which may affect the quality or quantity of the drinking water (see also section R309-500-6).

**"Public Water System"** (PWS) means a system, either publicly or privately owned, providing water through constructed conveyances for human consumption and other domestic uses, which has at least 15 service connections or serves an average of at least 25 individuals daily at least 60 days out of the year and includes collection, treatment, storage, or distribution facilities under the control of the operator and used primarily in connection with the system, or collection, pretreatment or storage facilities used primarily in connection with the system but not under his control (see 19-4-102 of the Utah Code Annotated). All public water systems are further categorized into three different types, community (CWS), non-transient non-community (NTNCWS), and transient non-community (TNCWS). These categories are important with respect to required monitoring and water quality testing found in R309-205 and R309-210 (see also definition of "water system").

**"Raw Water"** means water that is destined for some treatment process that will make it acceptable as drinking water. Common usage of terms such as lake or stream water, surface water or irrigation water are synonymous with raw water.

**"Recreational Home Developments"** are subdivision type developments wherein the dwellings are not intended as permanent domiciles.

**"Recreational Vehicle Park"** means any site, tract or parcel of land on which facilities have been developed to provide temporary living quarters for individuals utilizing recreational vehicles. Such a park may be developed or owned by a private, public or non-profit organization catering to the general public or restricted to the organizational or institutional member and their guests only.

**"Regional Operator"** means a certified operator who is in direct responsible charge of more than one public drinking water system.

**"Regionalized Water System"** means any combination of water systems which are physically connected or operated or managed as a single unit.

**"Rem"** means the unit of dose equivalent from ionizing radiation to the total body or any internal organ or organ system. A "millirem" (mrem) is 1/1000 of a rem.

**"Renewal Course"** means a course of instruction, approved by the Subcommittee, which is a prerequisite to the renewal of a Backflow Technician's Certificate.

**"Repeat compliance period"** means any subsequent compliance period after the initial compliance period.

**"Replacement well"** means a public supply well drilled for the sole purpose of replacing an existing public supply well which is impaired or made useless by structural difficulties and in which the following conditions are met:

(1) the proposed well location shall be within a radius of 150 feet from an existing ground water supply well; and

(2) the PWS provides a copy of the replacement application approved by the State Engineer (refer to Section 73-3-28 of the Utah Code).

**"Required reserve"** means funds set aside to meet requirements set forth in a loan covenant/bond indenture.

**"Residual Disinfectant Concentration"** ("C" in CT calculations) means the concentration of disinfectant, measured in mg/L, in a representative sample of water.

**"Restricted Certificate"** means that the operator has qualified by passing an examination but is in a restricted certification status due to lack of experience as an operator.

**"Roadway Rest Stop"** shall mean any building, or buildings, or grounds, parking areas, including the necessary toilet, hand washing, water supply and wastewater facilities intended for the accommodation of people using such facilities while traveling on public roadways. It does not include scenic view or roadside picnic areas or other parking areas if these are properly identified

**"Routine Chemical Monitoring Violation"** means no routine chemical sample(s) was taken as required in R309-205, R309-210 and R309-215.

**"Safe Yield"** means the annual quantity of water that can be taken from a source of supply over a period of years without depleting the source beyond its ability to be replenished naturally in "wet years".

**"Sanitary Seal"** means a cap that prevents contaminants from entering a well through the top of the casing.

**"scfm/sf"** means standard cubic foot per minute per square foot and is one way of expressing flowrate of air at standard density through a filter or duct area.

**"Secondary Disinfection"** means the adding of an acceptable secondary disinfectant to assure that the quality of the water is maintained throughout the distribution system. The effectiveness is measured by maintaining detectable disinfectant residuals throughout the distribution system. Acceptable secondary disinfectants are chlorine, chloramine, and chlorine dioxide.

**"Secondary Maximum Contaminant Level"** means the advisable maximum level of contaminant in water which is delivered to any user of a public water system.

**"Secretary to the Subcommittee"** means that individual appointed by the Executive Secretary to conduct the business of the Subcommittee.

**"Sedimentation"** means a process for removal of solids before filtration by gravity or separation.

**"Semi-Developed Camp"** means a campground accessible by any type of vehicular traffic. Facilities are provided for both protection of site and comfort of users. Roads, trails and campsites are defined and basic facilities (water, flush toilets and/or vault toilets, tables, fireplaces or tent pads) are provided. These camps include but are not limited to National Forest campgrounds, Bureau of Reclamation campgrounds, and youth camps.

**"Service Connection"** means the constructed conveyance by which a dwelling, commercial or industrial establishment, or other water user obtains water from the supplier's distribution system. Multiple dwelling units such as condominiums or apartments, shall be considered to have a single service connection, if fed by a single line, for the purpose of microbiological repeat sampling; but shall be evaluated by the supplier as multiple "equivalent residential connections" for the purpose of source and storage capacities.

**"Service Factor"** means a rating on a motor to indicate an increased horsepower capacity beyond nominal nameplate capacity for occasional overload conditions.

**"Service line sample"** means a one-liter sample of water collected in accordance with R309-210-6(3)(b)(iii), that has been standing for at least 6 hours in a service line.

**"Single family structure"** for the purposes of R309-210-6 only, means a building constructed as a single-family residence that is currently used as either a residence or a place of business.

**"Small water system"** means a public water system that serves 3,300 persons or fewer.

**"Specialist"** means a person who has successfully passed the written certification exam and meets the required experience, but who is not in direct employment with a Utah public drinking water system.

**"Stabilized drawdown"** means that there is less than 0.5 foot of change in water level measurements in a pumped well for a minimum period of six hours.

**"Standard sample"** means the aliquot of finished drinking water that is examined for the presence of coliform bacteria.

**"SOCs"** means synthetic organic chemicals.

**"Stabilized Drawdown"** means the drawdown measurements taken during a constant-rate yield and drawdown test as outlined in subsection R309-515-14(10)(b) are constant (no change).

**"Subcommittee"** means the Cross Connection Control Subcommittee.

**"Supplier of water"** means any person who owns or operates a public water system.

**"Surface Water"** means all water which is open to the atmosphere and subject to surface runoff (see also section R309-204-5(1)). This includes conveyances such as ditches, canals and aqueducts, as well as natural features.

**'Surface Water Systems"** means public water systems using surface water or ground water under the direct influence of surface water as a source that are subject to filtration and disinfection (Federal SWTR subpart H) and the requirements of R309-215 "Monitoring and Water Quality: Treatment Plant Monitoring Requirements."

**"Surface Water Systems (Large)"** means public water systems using surface water or ground water under the direct influence of surface water as a source that are subject to filtration and disinfection and serve a population of 10,000 or greater (Federal SWTR subpart P and L) and the requirements of R309-215 "Monitoring and Water Quality: Treatment Plant Monitoring Requirements."

**"Surface Water Systems (Small)"** means public water systems using surface water or ground water under the direct influence of surface water as a source that are subject to filtration and disinfection and serve a population less than 10,000 (Federal SWTR subpart L, T and P (sanitary survey requirements)) and the requirements of R309-215 "Monitoring and Water Quality: Treatment Plant Monitoring Requirements."

**"Susceptibility"** means the potential for a PWS (as determined at the point immediately preceding treatment, or if no treatment is provided, at the entry point to the distribution system) to draw water contaminated above a demonstrated background water quality concentration through any overland or subsurface pathway. Such pathways may include cracks or fissures in or open areas of the surface water intake, and/or the wellhead, and/or the pipe/conveyance between the intake and the water distribution system or treatment.

**"SUVA"** means Specific Ultraviolet Absorption at 254 nanometers (nm), an indicator of the humic content of water. It is a calculated parameter obtained by dividing a sample's ultraviolet absorption at a wavelength of 254 nm ($UV_{254}$) (in $m^{-1}$) by its concentration of dissolved organic carbon (DOC) (in mg/L).

**"System with a single service connection"** means a system which supplies drinking water to consumers via a single service line.

**"T"** is short for "Contact Time" and is generally used in conjunction with either the residual disinfectant concentration (C) in determining CT or the velocity gradient (G) in determining mixing energy GT.

**"Ten State Standards"** refers to the Recommended Standards For Water Works, 1997 by the Great Lakes Upper Mississippi River Board of State Public Health and Environmental Managers available from Health Education Services, A Division of Health Research Inc., P.O. Box 7126, Albany, New York 12224, (518)439-7286.

**"Time of travel"** means the time required for a particle of water to move in the producing aquifer from a specific point to a ground water source of drinking water. It also means the time required for a particle of water to travel from a specific point along a surface water body to an intake.

**"Total Inactivation Ratio"** is the sum of all the inactivation ratios calculated for a series of disinfection sequences, and is indicated or shown as: "Summation sign $(CT_{calc})/(CT_{req'd})$." A total inactivation ratio equal to or greater than 1.0 is assumed to provide the required inactivation of Giardia lamblia cysts. $CT_{calc}/CT_{99.9}$ equal to 1.0 provides 99.9 percent (3-log) inactivation, whereas $CT_{calc}/CT_{90}$ equal to 1.0 only provides 90 percent (1-log) inactivation.

**"Too numerous to count"** (TNTC) means that the total number of bacterial colonies exceeds 200 on a 47 mm diameter membrane filter used for coliform detection.

**"Total Organic Carbon"** (TOC) means total organic carbon in mg/L measured using heat, oxygen, ultraviolet irradiation, chemical oxidants, or combinations of these oxidants that convert organic carbon to carbon dioxide, rounded to two significant figures.

**"Total Trihalomethanes"** (TTHM) means the MCL for trihalomethanes. This is the sum of four of ten possible isomers of chlorine/bromine/methane compounds, all known as trihalomethanes (THM). TTHM is defined as the arithmetic sum of the concentrations in micro grams per liter of only four of these (chloroform, bromodichloromethane, dibromochloromethane, and bromoform) rounded to two significant figures. This measurement is made by samples which are "quenched," meaning that a chlorine neutralizing agent has been added, preventing further THM formation in the samples.

**"Training Coordinating Committee"** means the voluntary association of individuals responsible for environmental training in the state of Utah.

**"Transient Non-Community Water System"** (TNCWS) means a non-community public water system that does not serve 25 of the same nonresident persons per day for more than six months per year. Examples of such systems are those, RV

park, diner or convenience store where the permanent nonresident staff number less than 25, but the number of people served exceeds 25.

"**Treatment Plant"** means those facilities capable of providing any treatment to any water serving a public drinking water system. (Examples would include but not be limited to disinfection, conventional surface water treatment, alternative surface water treatment methods, corrosion control methods, aeration, softening, etc.)

**"Treatment Plant Manager"** means the individual responsible for all operations of a treatment plant.

**"Trihalomethanes"** (THM) means any one or all members of this class of organic compounds.

**"Trihalomethane Formation Potential"** (THMFP) - these samples are collected just following disinfection and measure the highest possible TTHM value to be expected in the water distribution system. The formation potential is measured by not neutralizing the disinfecting agent at the time of collection, but storing the sample seven days at 25 degrees C prior to analysis. A chlorine residual must be present in these samples at the end of the seven day period prior to analysis for the samples to be considered valid for this test. Samples without a residual at the end of this period must be resampled if this test is desired.

**"Turbidity Unit"** refers to NTU or Nephelometric Turbidity Unit.

**"UDI"** means under direct influence (see also "Ground Water Under the Direct Influence of Surface Water").

**"Uncovered finished water storage facility"** is a tank, reservoir, or other facility used to store water that will undergo no further treatment except residual disinfection and is open to the atmosphere.

**"Unprotected aquifer**" means any aquifer that does not meet the definition of a protected aquifer.

**"Unregulated Contaminant"** means a known or suspected disease causing contaminant for which no maximum contaminant level has been established.

**"Unrestricted Certificate"** means that a certificate of competency issued by the Executive Secretary when the operator has passed the appropriate level written examination and has met all certification requirements at the discipline and grade stated on the certificate.

**"Virus"** means a virus of fecal origin which is infectious to humans.

**"Waterborne Disease Outbreak"** means the significant occurrence of acute infectious illness, epidemiologically associated with the ingestion of water from a public water system, as determined by the appropriate local or State agency.

**"Watershed"** means the topographic boundary that is the perimeter of the catchment basin that contributes water through a surface source to the intake structure. For the purposes of surface water DWSP, if the topographic boundary intersects the state boundary, the state boundary becomes the boundary of the watershed.

**"Water Supplier"** means a person who owns or operates a public drinking water system.

**"Water System"** means all lands, property, rights, rights-of-way, easements and related facilities owned by a single entity, which are deemed necessary or convenient to deliver drinking water from source to the service connection of a consumer(s). This includes all water rights acquired in connection with the system, all means of conserving, controlling and distributing drinking water, including, but not limited to, diversion or collection works, springs, wells, treatment plants, pumps, lift stations, service meters, mains, hydrants, reservoirs, tanks and associated appurtenances within the property or easement boundaries under the control of or controlled by the entity owning the system.

In accordance with R309, certain water systems may be exempted from monitoring requirements, but such exemption does not extend to submittal of plans and specifications for any modifications considered a public drinking water project.

**"Wellhead"** means the physical structure, facility, or device at the land surface from or through which ground water flows or is pumped from subsurface, water-bearing formations.

**"Zone of Influence"** corresponds to area of the upper portion of the cone of depression as described in "Groundwater and Wells," second edition, by Fletcher G. Driscoll, Ph.D., and published by Johnson Division, St. Paul, Minnesota.

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# R309-500. Plan Review, Operation and Maintenance Requirements (Effective August 15, 2001)

## Table of Contents

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# R309-500. Facility Design and Operation: Plan Review, Operation and Maintenance Requirements.

## *R309-500-1. Purpose.*

The purpose of this rule is to describe plan review procedures and requirements, clarify projects requiring review, and inspection requirements for drinking water projects. It is intended to be applied in conjunction with rules R309-500 through R309-550. Collectively, these rules govern the design, construction, operation and maintenance of public drinking water system facilities. These rules are intended to assure that such facilities are reliably capable of supplying adequate quantities of water which consistently meet applicable drinking water quality requirements and do not pose a threat to general public health.

## *R309-500-2. Authority.*

This rule is promulgated by the Drinking Water Board as authorized by Title 19, Environmental Quality Code, Chapter 4, Safe Drinking Water Act, Subsection 104(1)(a)(ii) of the Utah Code and in accordance with 63-46a of the same, known as the Administrative Rulemaking Act.

## *R309-500-3. Definitions.*

Definitions for certain terms used in this rule are given in R309-110 but may be further clarified herein.

## *R309-500-4. General.*

### (1) Construction and Operation of New Facilities.

As authorized in 19-4-106(3) of the Utah Code, the Executive Secretary may review plans, specifications, and other data pertinent to proposed or expanded water supply systems to insure proper design and construction.

Plans and specifications and a business plan as required by R309-800-5, along with a completed project notification form, shall be submitted to the Executive Secretary for any new water systems or previously un-reviewed water systems unless acceptable data can be presented that the proposed or existing water system will not become a "public water system" as defined in 19-4-102 of the Utah Code or in R309-110.

Construction of new facilities for public water systems or existing facilities of previously un-reviewed public drinking water systems shall conform with rules R309-500 through R309-550; the "Facility Design and Operation" rules. There may be times in which the requirements of the Facility Design and Operation rules are not appropriate. Thus, the Executive Secretary may grant an "exception" to the Facility Design and Operation rules if it can br shown that the granting of such an exception will not jeopardize the public health.

Construction of a public drinking water project shall not begin until complete plans and specifications have been approved in writing by the Executive Secretary unless waivers have been issued as allowed by R309-500-6(3). This approval shall be referred to as the Plan Approval.

Furthermore, no new public drinking water facility shall be put into operation until written approval to do so has been given by the Executive Secretary or this requirement waived. This approval is referred to as the Operating Permit.

## (2) Existing Facilities.

All existing public drinking water systems shall be capable of reliably delivering water which meets the minimum current standard of drinking water quantity and quality requirements. The Executive Secretary may require modification of existing systems in accordance with R309-500 through R309-550 when such modifications are needed to reliably achieve minimum quantity and quality requirements.

***Guidance: Existing public drinking water facilities should be upgraded to meet all current design and operation standards. Furthermore, R309-150, the Water System Rating Criteria, compels existing systems to correct deficiencies or risk a "Not Approved" rating. Thus, operators of existing systems are encouraged to continually evaluate their facilities with respect to current design and operation standards***.

## (3) Operation and Maintenance of Existing Facilities.

Public drinking water system facilities shall be operated and maintained in a manner which protects the public health. As a minimum, the operation and maintenance procedures of R309-500 through R309-550 shall be adhered to.

***Guidance: In accordance with R309-104-2, certain water systems; which consist only of distribution and storage facilities ( no collection or treatment) ; obtains all of it's water from another public water system which is required to monitor; does not sell water; and is not a carrier which conveys passengers in interstate commerce, may be exempted from monitoring requirements of R309-104. Such exemption does not extend to submittal of plans and specifications for any modifications considered a public drinking water project as outlined below. Additionally, if the system serves sufficient***

***connections or individuals to be considered a "public water system", its management must keep current those names, addresses and phone numbers required by R309-101-1.2.***

## *R309-500-5. Public Drinking Water Project*

### (1) Definition.

A public drinking water project, requiring the submittal of a project notification form along with plans and specifications, is any of the following:

(a) The construction of any facility for a proposed drinking water system (see 19-4-106(3) of the Utah Code or R309-500-4(1) above describing the authority of the Executive Secretary).

(b) Any addition to, or modification of, the facilities of an existing public drinking water system which may affect the quality or quantity of water delivered.

(c) Any activity, other than on-going operation and maintenance procedures, which may affect the quality or quantity of water delivered by an existing public drinking water system. Such activities include:

(i) the interior re-coating or re-lining of any raw or drinking water storage tank, or water storage chamber within any treatment facility,

(ii) the "in-situ" re-lining of any pipeline,

(iii) a change or addition of any primary coagulant water treatment chemical (excluding filter, floc or coagulant aids) when the proposed chemical does not appear on a list of chemicals pre-approved by the Executive Secretary for a specific treatment facility, and

***Guidance: The Division of Drinking Water will maintain a list of primary coagulant treatment chemicals which are "pre-approved" for use at a given plant. Plant operators will be required to only use primary coagulant chemicals from this list. When a different primary coagulant chemical is desired for use, this chemical must be reviewed by the Executive Secretary and may be added to the "pre-approved" list for a given plant.***

(iv) the re-development of any spring or well source or replacement of a well pump with one of different capacity.

## (2) On-going Operation and Maintenance Procedures.

On-going operation and maintenance procedures are not considered public drinking water projects and, accordingly, are not subject to the project notification, plan approval and operating permit requirements of this rule. However, these activities shall be carried out in accordance with all operation and maintenance requirements contained in R309-500 through R309-550 and specifically the disinfection, flushing and bacteriological sampling and testing requirements of ANSI/AWWA C651-92 for pipelines, ANSI/AWWA C652-92 for storage facilities, and ANSI/AWWA C654-97 for wells before they are placed back into service. The following activities are considered to be on-going operation and maintenance procedures:

(a) pipeline leak repair,

(b) replacement of existing deteriorated pipeline where the new pipeline segment is the same size as the old pipeline,

(c) distribution pipeline additions where the pipeline size is the same as the main supplying the addition, the length is less than 500 feet and contiguous segments of new pipe total less than 1000 feet in any fiscal year,

(d) entry into a drinking water storage facility for the purposes of inspection, cleaning and maintenance, and

(e) replacement of equipment or pipeline appurtenances with the same type, size and rated capacity (fire hydrants, valves, pressure regulators, meters, service laterals, chemical feeders and booster pumps including deep well pumps).

## *R309-500-6. Plan Approval Procedure.*

***Guidance:***

***Submittal of plans and specifications for drinking water projects are required of owners, operators, and managers of public water systems (pws).***

***Many times the Division receives a submittal directly from developers of subdivisions that will be served by a pws, or engineers who are on contract to the developer rather than the pws. We have no objections to a pws obligating a developer to provide the time, energy, and cost necessary to prepare a set of plans and specifications, but such should be reviewed by the pws for conformance with their own specific requirements prior to submittal, and the submittal to the Division made by the management of the pws rather than others.***

***Also keep in mind that local agencies approve subdivision plats not the Division; that the plans and specifications submitted should be final and complete enough for actual construction of the additions or modifications to the pws's existing facilities; that additional information, even***

***beyond that outlined below, may be required by the Division prior to construction (e.g. hydraulic analysis of existing system plus additions, local requirements for fire flow and duration, proximity of sewer and other utilities); and that the plans and specifications must be stamped and signed by a registered professional engineer licensed to practice in the state of Utah.***

## (1) Project Notification.

The Division shall be notified prior to the construction of any "public drinking water project" as defined in R309-500-5(1) above. The notification may be prior to or simultaneous with submission of construction plans and specifications as required by R309-500-6(2) below. Notification shall be made by the management of the regulated public water system on a form provided by the Division. Information required by this form shall be determined by the Division and may include:

(a) whether the project is for a new or existing public drinking water system,

(b) the professional engineer, registered in the State of Utah, designing the project and his/her experience designing public drinking water projects within the state,

(c) the individual(s) who will be inspecting the project during construction and whether such inspection will be full-time or part time,

(d) whether required approvals or permits from other governmental agencies (e.g. local planning commissions, building inspectors, Utah Division of Water Rights) are awaiting approval by the Executive Secretary, the agency's name and contact person,

(e) the fire marshal, fire district or other entity having legal authority to specify requirements for fire suppression in the project area,

(f) for community and non-transient non-community public water systems or any public water system treating surface water, the name of the certified operator who is, or will be, in direct responsible charge of the water system,

(g) whether the water system has a registered professional engineer employed, appointed or designated as being directly responsible for the entire system design and his or her name and whether the system is requesting waiving of plan submittal under conditions of R309-500-6(3),

(h) the anticipated construction schedule, and

(i) a description of the type of legal entity responsible for the water system (i.e. corporation, political subdivision, mutual ownership, individual ownership, etc.)

and the status of the entity with respect to the rules of the Utah Public Service Commission.

***Guidance: The Utah Public Service Commission (PSC) regulates water utilities meeting the definition of a "water corporation" as found in 54-2-1 of the Utah Code. However, water utilities owned by political subdivisions are generally exempt if certain conditions are met. All public water systems should refer to Title 54 of the Utah Code and R746-331 of the Utah Administrative Code and approach the PSC for a determination of whether the system qualifies for an exemption form their rules.***

## (2) Pre-Construction Requirements.

All of the following shall be accomplished before construction of any public drinking water project commences:

(a) Contract documents, plans and specifications for a public drinking water project shall be submitted to the Division at least 30 days prior to the date on which action is desired unless the system is eligible for and has requested waiving of plan submittal. Any submittal shall include engineering reports, pipe network hydraulic analyses, water consumption data, supporting information, evidence of rights-of-way and reference to any previously submitted master plans pertinent to the project, along with a description of a program for keeping existing water works facilities in operation during construction so as to minimize interruption of service.

***Guidance: Review of complicated projects, especially water treatment facilities, may require more that 30 days and should be submitted well in advance of the date on which action is desired.***

(b) Plans and specifications shall be prepared for every anticipated public water system project. The design utilized shall conform to the requirements of R309-500 through R309-550. Furthermore, the plans and specification shall be sufficiently detailed to assure that the project shall be properly constructed. Drawings shall be compatible with Division's document storage and microfilming practice. Drawings which are illegible or of unusual size shall not be accepted for review. Drawing size shall not exceed 30" x 42" nor be less than 8-1/2" x 11".

(c) The plans and specifications shall be stamped and signed by a licensed professional engineer in accordance with Section 58-22-602(2) of the Utah Code.

***Guidance: 58-22-602(2) in part reads: "Any final plan, specification, and report prepared by, or under the supervision of, the professional engineer shall bear the seal of the professional engineer when submitted to a client, when filed with public authorities, ...". As authorized by 19-4-104(1)(b), the Drinking Water Board may "require the submission to the executive secretary of plans and***

***specifications for construction of, substantial addition to, or alteration of public water systems for review and approval by the board before that action begins and require any modifications or impose any conditions that may be necessary to carry out the purposes of this chapter.***"

***Therefore the Drinking Water Board is considered as the State Authority having regulatory control over public water systems and any submittal tot he board, through the executive secretary, on behalf of a client is considered a filing with public authorities and required to bear the stamp and signature of a professional engineer.***

***Staff at the Division are repeatedly questioned concerning the need to have a licensed professional engineer stamp and sign sketches, drawings, or plans submitted for review, especially where simple waterline extensions or additions are concerned. 58-22-102(9) of the Utah Code in part defines "Professional engineering or the practice of engineering" as meaning any service or creative work, the adequate performance of which requires engineering education, training, and experience in the application of special knowledge of the mathematical, physical, and engineering sciences to such services or creative work as...planning, design, and design coordination of engineering works and systems...any of which embraces such services or work, either public or private, in connection with any utilities....and including such other professional services as may be necessary to the planning, progress and completion of any engineering services.***

***The Division, the Executive Secretary, and the Board cannot waive requirements of other agencies; therefore small public water systems are encouraged to utilize a professional engineer to create a meaningful "master plan" and "standard system drawings", have them reviewed and approved by the Executive Secretary one time, then they may construct the system in phases by simply notifying the Division, citing the previously approved submittal, and requesting a waiver of our requirement for plans and specifications submittal for the current construction phase as allowed by R309-500-6(3)(a).***

(d) Plans and specifications shall be reviewed for conformance with R309-500 through R309-550. No work shall commence on a public water system project until a plan approval has been issued by the Executive Secretary unless conditions outlined in R309-500-6(3) are met and waiving of plan submittal has been requested. If construction or the ordering of substantial equipment has not commenced within one year, a renewal of the Plan Approval shall be obtained prior to proceeding with construction.

(e) If, in the judgment of the Executive Secretary, alternate designs or specific solutions can protect the public health to the same or greater extent as achieved in

R309-500 through R309-550, the Executive Secretary may grant an exception thereto (see the third paragraph of R309-500-4(1)).

(f) Novel equipment or treatment techniques may be developed which are not specifically addressed by these rules. These may be accepted by the Executive Secretary if it can be shown that:

(i) the technique will produce water meeting the requirements of R309-200 of these rules,

(ii) the Executive Secretary has determined that it will protect public health to the same extent provided by comparable treatment processes outlined in these rules, and

(iii) the Executive Secretary has determined the technique is as reliable as any comparable treatment process outlined is these rules.

## (3) Waiving of Plan Submittal Requirement.

With identification of a professional engineer, as indicated below, on a project notification form the plan submittal requirement may be waived for certain projects. In these instances, in lieu of plans and specifications, a "certification of rule conformance" shall be submitted along with the additional information required for an operating permit (see R309-500-9), signed by the professional engineer identified to Executive Secretary in (b) or, if the system has not employed, appointed, or designated such, the registered professional engineer who prepared the items in (a). Projects eligible for this waiving of plan submittal are:

(a) distribution system improvements which conform to a "master plan" previously reviewed and approved by the Executive Secretary and installed in accordance with the "system's standard drawings," also previously reviewed and approved by the Executive Secretary, or

(b) distribution system improvements consisting solely of pipelines and pipeline appurtenances (excluding pressure reducing valve stations and in-line booster pump stations);

(i) less than or equal to 4 inches in diameter in water systems (without fire hydrants) serving solely a residential population less than 3,300;

(ii) less than or equal to 8 inches in diameter in water systems (with fire hydrants) providing water for mixed use (commercial, industrial, agricultural and/or residential) to a population less than 3,300;

(iii) less than or equal to 12 inches in diameter in water systems(with fire hydrants) providing water for mixed use to a population between 3,300 and 50,000;

(iv) less than or equal to 16 inches in diameter in water systems (with fire hydrants) providing water for mixed use to a population greater than 50,000.

Additionally, the above systems shall employ, appoint or designate a registered professional engineer who is directly responsible for the entire public water system design and identify this individual to the Executive Secretary before being eligible for waiving of plan submittal requirements.

## *R309-500-7. Inspection During Construction.*

Staff from the Division, or the appropriate local health department, after reasonable notice and presentation of credentials may make visits to the work site to assure compliance with these rules.

***Guidance: It is recommended that a full-time inspector(s), familiar with these rules, be retained to observe all construction activities. This is particularly important for buried facilities such as pipelines.***

## *R309-500-8. Change Orders.*

Any deviations from approved plans or specifications affecting capacity, hydraulic conditions, operating units, the functioning of water treatment processes, or the quality of water to be delivered, shall be reported to the Executive Secretary. If deemed appropriate, the Executive Secretary may require that revised plans and specifications be submitted for review. Revised plans or specifications shall be submitted to the Division in time to permit the review and approval of such plans or specifications before any construction work, which will be affected by such changes, is begun.

## *R309-500-9. Issuance of Operating Permit.*

The Division shall be informed when a public drinking water project, or a well-defined phase thereof, is at or near completion. The new or modified facility shall not be used until an "Operating Permit" is issued, in writing, by the Executive Secretary. This permit shall not be issued until all of the following items are submitted and found to be acceptable for all projects with the exception of distribution lines (including in-line booster pump stations or pressure reducing stations), which may be placed into service prior to submittal of all items if the

professional engineer responsible for the entire system, as identified to the Executive Secretary, has received items (1) and (4):

(1) a statement from a registered professional engineer that all conditions of Plan Approval were accomplished ("certification of rule conformance"),

(2) as-built "record" drawings; unless no changes are made from previously submitted and approved plans during construction,

(3) confirmation that a copy of the as-built "record" drawings has been received by the water system owner,

(4) evidence of proper flushing and disinfection in accordance with the appropriate ANSI/AWWA Standard,

(5) where appropriate, water quality data

(6) a statement from the Engineer indicating what changes to the project were necessary during construction, and certification that all of these changes were in conformance with these rules ("certification of rule conformance"),

(7) all other documentation which may have been required during the plan review process, and

(8) confirmation that the water system owner has been provided with an Operation and Maintenance manual for the new facility.

## *R309-500-10. Adequacy of Wastewater Disposal.*

Plans and specifications for new water systems, or facilities required as a result of proposed subdivision additions to existing water systems, shall only be approved if the method(s) of wastewater disposal in the affected area have been approved, or been determined to be feasible, by the Utah Division of Water Quality or the appropriate local health agency.

## *R309-500-11. Financial Viability.*

Owners of new or existing water systems are encouraged to develop realistic financial strategies for recouping the costs of constructing and operating their systems. Plans for water system facilities shall not be approved when it is obvious that public health will eventually be threatened because the anticipated usage of the system will not generate sufficient funds to insure proper operation and maintenance of the system (see also R309-352-5).

***Guidance: To permit an evaluation in this regard, capital and operating cost estimates should be provided along with the engineering plans and specifications for any proposed project.***

## *R309-500-12. Fee Schedule.*

The Division may charge a fee for the review of plan and specifications. A fee schedule is available from the Division.

***Guidance: Current Plan Review Filing Charge is $200. If the project involves a new well, a Well Grout Sealing Inspection fee of $50.00 per hour (plus mileage and "per diem" food and lodging expenses) is charged to the driller by the Division.***

## *R309-500-13. Other Permits.*

Local, county or other state permits may also be necessary before beginning construction of any drinking water project.

## *R309-500-14. Reference Documents.*

All references made in R309-500 through R309-550 are available for inspection at the Division's office.

## *R309-500-15. Violations of These Rules.*

Violations of rule contained in R309-500 through R309-550 are subject to the provisions of the Utah Safe Drinking Water Act (Title 19, Chapter 4 Section 109 of the Utah Code) and may be subject to fines and penalties.

***Guidance: Safety***

***The requirements of the Utah Occupational Safety and Health Administration (UOSHA) shall be met during the construction or operation of public drinking water facilities. However these rules are not enforced by the Division and, furthermore, Division inspections do not include safety-related items.***

**KEY: drinking water, plan review, operation and maintenance requirements, permits**

**August 15, 2001** **19-4-104**

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# R309-505 Minimum Treatment Requirements (Effective August 15, 2001)

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# R309-505. Minimum Treatment Requirements.

## *R309-505-1. Purpose.*

This rule specifies the type and degree of treatment which must be applied to the various types of water sources found in Utah. It is intended to be applied in conjunction with rules R309-500 through R309-550. Collectively, these rules govern the design, construction, operation and maintenance of public drinking water system facilities. These rules are intended to assure that such facilities are reliably capable of supplying adequate quantities of water which consistently meet applicable drinking water quality requirements and do not pose a threat to general public health.

## *R309-505-2. Authority.*

This rule is promulgated by the Drinking Water Board as authorized by Title 19, Environmental Quality Code, Chapter 4, Safe Drinking Water Act, Subsection 104(1)(a)(ii) of the Utah Code and in accordance with Title 63, Chapter 46a of the same, known as the Administrative Rulemaking Act.

## *R309-505-3. Definitions.*

Definitions for certain terms used in this rule are given in R309-110 but may be further clarified herein.

## *R309-505-4. Pre-design Consultation.*

The type and degree of treatment which shall be given a public drinking water source depends upon the nature of the source and the chemical and biological characteristics of the water it produces. Prior to the design of any water treatment facility, the Executive Secretary shall be consulted and concur that the contemplated treatment method is appropriate for the source being treated.

## *R309-505-5. Drinking Water Quality Standards.*

Drinking water provided for human consumption by public drinking water systems must meet all water quality standards as specified in R309-103. Sources of water which do not meet applicable standards, or may not meet such standards due to the proximity of contamination sources, shall be appropriately treated as specified herein or physically disconnected from the drinking water system.

## *R309-505-6. Surface Water Sources.*

### (1) Determination of Surface Water Source.

A surface water source is any water source which rests or travels above ground for any period of time. Such sources include rivers, streams, creeks, lakes, reservoirs, ponds or impoundments.

### (2) Treatment of a Surface Water Source.

(a) As a minimum, surface water sources shall be given complete treatment as specified in R309-525 or R309-530.

(b) All surface waters shall be treated to assure:

(i) at least 99.9 percent (3-log) removal and/or inactivation of Giardia lamblia cysts between a point where the raw water is not subject to re-contamination by surface water runoff and a point downstream before or at the first customer;

(ii) at least 99.99 percent (4-log) removal and/or inactivation of viruses between a point where the raw water is not subject to re-contamination by surface water runoff and a point downstream before or at the first customer; and

(iii) removal of substances, as needed, to comply with the quality requirements of R309-103.

(c) A public water system using a surface water source is considered to be in compliance with the requirements in subsection (b), above, if the treatment technique utilized produces water meeting the quality provisions of R309-103, provided that all monitoring required by R309-104 has been accomplished.

## *R309-505-7. Low Quality Ground Water Sources.*

## (1) Determination of a Low Quality Ground Water Source.

(a) A low quality ground water source is any well or spring which, as determined by the Executive Secretary, cannot reliably and consistently meet the drinking water quality standards described in R309-103. A water source shall be deemed to be a low quality ground water source if any of the following conditions exist:

(i) It is determined by the Executive Secretary that the source is Ground Water Under the Direct Influence of Surface Water.

(A) Classification of existing ground water sources, as to whether or not they are under direct influence of surface water, shall be made by the Executive Secretary.

***Guidance: System operators and engineers are encouraged to monitor existing or planned sources so as to determine the possibility of surface water influence.***

.

(B) Frequent monitoring of turbidity, temperature, pH and conductivity of source water, in conjunction with similar monitoring of nearby surface waters may, if properly documented, provide sufficient evidence that the source is not influenced.

***Guidance: System operators and engineers are encouraged to contact the Division for further advise prior to any monitoring.***

(C) Classification of existing sources shall be based upon evaluation of part or all of the following:

(I) Records review; including review of plans and specifications used for construction of collection facilities as submitted for review and approval prior to construction; review of as-built plans as submitted after construction, especially where springs are concerned; review of previous sanitary surveys; and review of any system bacteriological violations which may be linked directly to a source.

(II) Results of written survey form.

(III) On-site inspection by Division personnel.

(IV) Special tests such as Microscopic Particulate Analysis (MPA), dye tracer studies, or time of travel studies done in conjunction with the source protection program. Because of critical timing for tests such as the MPA, accelerated monitoring and reporting of water characteristics as

mentioned in R309-505-7 (1)(a)(i)(B) above, may be required prior to MPA sampling.

(b) Testing for microbiological, chemical or radiologic contaminants determines that the drinking water quality requirements of R309-103 cannot be reliably or consistently met.

(c) The location, design or construction of the well or spring makes it, in the judgement of the Executive Secretary, susceptible to natural or man-caused contamination.

### (2) Treatment of a Low Quality Ground Water Source.

Low quality ground water sources shall be treated to assure that all chemical and biological contaminants are reduced to the levels which are reliably and consistently below MCL's prescribed in R309-103. If a source is determined to be ground water under the direct influence of surface water the following is required:

(a) Upon determination that a ground water source is under the direct influence of surface water, conventional surface water treatment, as specified in R309-525,or an approved equivalent, as specified in R309-530, shall be installed within 18 months or the source must be abandoned as a source of drinking water and physically disconnected from the drinking water system.

(b) Systems which must retain use of ground water sources classified as under direct influence of surface water shall start disinfection immediately on those sources and monitor in accordance with residual disinfectant monitoring under treatment plant monitoring and reporting found in R309-104- as well as maintain satisfactory "CT" values in accordance with R309-103-2.7 during the 18 month interim period before conventional surface water treatment, or an approved equivalent, is installed. Chlorine, chlorine dioxide, chloramine, and ozone are considered capable of attaining required levels of disinfection.

(c) Once a ground water source is classified as under the influence of surface water, it must be considered to be a surface water source. Thus, all requirements in these rules which pertain to surface water sources also pertain to ground water under the direct influence of surface water.

## *R309-505-8. High Quality Ground Water Sources.*

### (1) Determination of a High Quality Ground Water Source.

A well or spring shall be deemed to be a high quality ground water source if the following conditions are met:

(a) The design and construction of the source are in conformance with these rules

(b) Testing establishes that all applicable drinking water quality standards, as given in R309-103, are met, and can be expected to be met in the future.

(c) The source is not susceptible to natural or man-caused contamination and, furthermore, adequate protection zones and management areas have been established in accordance with R309-600.

### (2) Treatment of a High Quality Ground Water Source.

A high quality ground water source requires no treatment.

***Guidance: Even though no treatment is required, the designer should consider what will happen if quality deteriorates with time. Wells and springs should be located so that, if necessary, water may be disinfected in such a way that anticipated CT values can be achieved.***

## *R309-505-9. Best Available Technologies (BATs).*

EPA has identified Best Available Technologies (BATs) in national regulations regarding drinking water. BATs include Activated Alumina, Coagulation/Filtration, Direct Filtration, Diatomite Filtration, Electrodialysis Reversal, Corrosion Control, Granulated Activated Carbon, Ion Exchange, Lime Softening, Reverse Osmosis, Polymer Addition and Packed Tower Aeration. Where a BAT is used to reduce the concentration of a contaminant:

(a) the requirements of R309-500 through R309-550 shall govern if the BAT is included in these rules.

(b) if the BAT is not included in R309-500 through R309-550, review of plans and specifications for a project will be governed by R309-530-9, New Treatment Processes or Equipment.

## *R309-505-10. Point-of-Entry Treatment Devices.*

Where drinking water does not meet the quality standards of R309-103 and the available water system treatment methods are determined to be unreasonably costly or otherwise undesirable, the Executive Secretary may permit the public water supplier to install and maintain point-of-entry

treatment devices which have been proven to be appropriate, safe and effective as determined through testing and compliance with protocols established by EPA's Environmental Technology Verification Program (ETV) or the applicable ANSI/NSF Standard(s). The installation and maintenance of such devices shall be the sole responsibility of the public water supplier and service contracts shall make this clear.

## *R309-505-11. Temporary Use of Bottled Water or Point-of-Use Treatment Devices.*

Initially the use of bottled water, or point-of-use treatment devices, may be allowed on a temporary basis by the Executive Secretary. Their continued use shall be reviewed at least annually and only allowed after the Executive Secretary is satisfied that the PWS has made reasonable attempts since the last review to provide acceptable treatment of a more permanent nature without success. Point-of-use treatment devices used shall only be those proven to be appropriate, safe and effective as determined through testing and compliance with protocols established by EPA's Environmental Technology Verification Program (ETV) or the applicable ANSI/NSF Standard(s). Their installation and maintenance shall be under the control of a public water system and this made clear in service contracts between the consumer and the PWS.

**KEY: drinking water, surface water treatment, low quality ground water, high quality ground water**

**August 15, 2001** **19-4-104**

# R309-510 Minimum Sizing Requirements (Effective August 15, 2001)

## Table of Contents

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# R309-510. Minimum Sizing Requirements

## *R309-510-1. Purpose.*

This rule specifies requirements for the sizing of public drinking water facilities such as sources (along with their associated treatment facilities), storage tanks, and pipelines. It is intended to be applied in conjunction with R309-500 through R309-550. Collectively, these rules govern the design, construction, operation and maintenance of public drinking water system facilities. These rules are intended to assure that such facilities are reliably capable of supplying adequate quantities of water which consistently meet applicable drinking water quality requirements and do not pose a threat to general public health.

## *R309-510-2. Authority.*

This rule is promulgated by the Drinking Water Board as authorized by Title 19, Environmental Quality Code, Chapter 4, Safe Drinking Water Act, Subsection 104(1)(a)(ii) of the Utah Code and in accordance with 63-46a of the same, known as the Administrative Rulemaking Act.

## *R309-510-3. Definitions.*

Definitions for certain terms used in this rule are given in R309-110 but may be further clarified herein.

## *R309-510-4. General.*

This rule provides estimations which shall be used in the design of new systems, or if there is an absence of data collected by the public water system meeting the required confidence level for a reduction mentioned below, when evaluating water sources, storage facilities and pipelines. Within each of these three broad categories, the designer shall ascertain the contributions on demand from the indoor use of water, the outdoor use of water, and fire suppression activities (if required by local authorities). These components must be added together to determine the total demand on a given facility.

***Guidance: Rules in this section are designed to assure that a water system never runs out of water. This is not only an inconvenience for the public, but a risk to public health and safety. When a distribution goes dry, the risk of system contamination from in-leakage and backflow***

***increases. Furthermore, no fire protection would be available. Thus, the design engineer must give careful consideration to the daily and yearly variations of demand and verify that the system facilities are sufficient. Furthermore, the design engineer should consider how the system would behave during drought periods when demands may be higher than usual, and source yield (particularly the of springs) will likely be reduced.***

## *R309-510-5. Reduction of Requirements.*

If acceptable data are presented, at or above the 90% confidence level, showing that the requirements made herein are excessive for a given project, the requirements may be appropriately reduced on a case by case basis by the Executive Secretary. In the case of Recreational Home Developments, in order to qualify for a quantity reduction, not only must the actual water consumption be less than quantities required by rule (with the confidence level indicated above) but enforceable policy restrictions must have been approved which prevent the use of such dwellings as a permanent domicile and these restrictions shall have been consistently enforced.

## *R309-510-6. Water Conservation.*

This rule is based upon typical current water consumption patterns in the State of Utah. They may be excessive in certain settings where legally enforceable water conservation measures exist. In these cases the requirements made in this section may be reduced on a case-by-case basis by the Executive Secretary.

***Guidance: Drinking water systems are encouraged to use the water resources of the state wisely. Conservation measures such as low flow toilets and low water demand landscaping (xeriscaping) way significantly reduce the demands on water systems.***

## *R309-510-7. Source Sizing.*

### (1) Peak Day Demand and Average Yearly Demand.

Sources shall legally and physically meet water demands under two separate conditions. First, they shall meet the anticipated water demand on the day of highest water consumption. This is referred to as the peak day demand. Second, they shall also be able to provide one year's supply of water, the average yearly demand.

***Guidance: If the above two criteria are met, the source(s) can be relied upon to adequately serve the system under most, if not all, conditions. The term "legally", above, refers to what is permitted by the owner's water right. The design engineer should fully investigate the available water rights for a system. Water rights vary in the way they are written. Some are written in "cfs", others are written in terms of "AF". Still others are written in terms of allowable acreage or livestock. Furthermore, water rights may be restricted to certain times of the year, or certain uses (e.g. irrigation).***

***Consult the Division for assistance in determining how many connections a specific water right may support.***

## (2) Estimated Indoor Use.

In the absence of firm water use data, Tables 510-1 and 510-2 shall be used to estimate the peak day demand and average yearly demand for indoor water use.

**Table 510-1**
**Source Demand for Indoor Use**

| Type of Connection | Peak Day Demand | Average Yearly Demand |
|---|---|---|
| Year-Round Use | | |
| Residential | 800 gpd/conn | 146,000 gal./conn |
| ERC | 800 gpd/ERC | 146,000 gal./ERC |
| Seasonal / Non-Residential Use | | |
| Modern Recreation Camp | 60 gpd/person | (see note 1) |
| Semi-Developed Camp<br>a. With pit privies<br>b. With flush toilets | <br>5 gpd/person<br>20 gpd/person | <br>(See note1)<br>(See note 1) |
| Hotels, Motel & Resort | 150 gpd/person | (See note1) |
| Labor Camp | 50 gpd/person | (See note1) |
| Recreational Vehicle Park | 100 gpd/pad | (See note1) |
| Roadway Rest Stop | 400 gpd/conn | (See note1) |
| Recreational Home Development | 400 gpd/conn | (See note1) |

Note 1. Annual demand shall be based on the number of days the system will be open during the year times the peak day demand unless data acceptable to the Division, with a confidence level of 90% or greater showing a lesser annual consumption, can be presented.

**TABLE 510-2**
**SOURCE DEMAND FOR INDIVIDUAL ESTABLISHMENTS [a]**
**(Indoor Use)**

| Type of Establishment | Peak Day Demand (gpd) |
|---|---|
| Airports<br>a. per passenger<br>b. per employee | <br>3<br>15 |
| Boarding Houses<br>a. for each resident boarder and employee<br>b. for each nonresident boarders | <br>50<br>10 |
| Bowling Alleys, per alley<br>a. with snack bar<br>b. with no snack bar | <br>100<br>85 |
| Churches, per person | 5 |
| Country Clubs<br>a. per resident member<br>b. per nonresident member<br>c. per employee | <br>100<br>25<br>15 |
| Dentist's Office<br>a. per chair<br>b. per staff member | <br>200<br>35 |
| Doctor's Office<br>a. per patient<br>b. per staff member | <br>10<br>35 |
| Fairgrounds, per person | 1 |
| Fire Stations, per person<br>a. with full time employees and food prep<br>b. with no full time | <br>70 |

| | |
|---|---|
| employees and no food prep | 5 |
| Gyms<br>a. per participant<br>b. per spectator | <br>25<br>4 |
| Hairdresser<br>a. per chair<br>b. per operator | <br>50<br>35 |
| Hospitals, per bed space | 250 |
| Industrial Buildings, per 8 hour shift, per employee (exclusive of industrial waste)<br>a. with showers<br>b. with no showers | <br>35<br>15 |
| Launderette, per washer | 580 |
| Movie Theaters<br>a. auditorium, per seat<br>b. drive-in, per car space | <br>5<br>10 |
| Nursing Homes, per bed space | 280 |

**TABLE 510-2, Continued**
**Source Demand for Individual Establishments [(a)]**
**(Indoor Use)**

| Type of Establishment | Peak Day Demand |
|---|---|
| Office Buildings & Business Establishments, per shift, per employee (sanitary wastes only)<br>a. with cafeteria<br>b. with no cafeteria | <br><br>25<br>15 |
| Picnic Parks, per person (toilet wastes only) | 5 |
| Restaurants<br>a. ordinary restaurants (not 24 hour service) | <br>35 per seat |

| | |
|---|---|
| b. 24 hour service<br>c. single service customer utensils only<br>d. or, per customer served (includes toilet and kitchen wastes) | 50 per seat<br>2 per customer<br>10 |
| Rooming House, per person | 40 |
| Schools, per person<br>a. boarding<br>b. day, without cafeteria, gym or showers<br>c. day, with cafeteria, but no gym or showers<br>d. day, with cafeteria, gym and showers | <br>75<br>15<br>20<br>25 |
| Service Stations [(b)], per vehicle served | 10 |
| Skating Rink, Dance Halls, etc., per person<br>a. no kitchen wastes<br>b. additional for kitchen wastes | <br>10<br>3 |
| Ski Areas, per person (no kitchen waste) | 10 |
| Stores<br>a. per public toilet room<br>b. per employee | <br>500<br>11 |
| Swimming Pools and Bathhouses[(c)], per person | 10 |
| Taverns, Bars, Cocktail Lounges, per seat | 20 |
| Visitors Centers, per visitor | 5 |

**NOTES FOR TABLE 510-2:**

1. Source capacity must at least equal the peak day demand of the system. Estimate this by assuming the facility is used to its maximum.

2. Generally, storage volume must at least equal one average day's demand.

3. Peak instantaneous demands may be estimated by fixture unit analysis as per Appendix E of the 2000 International Plumbing Code.

(a) When more than one use will occur, the multiple use shall be considered in determining total demand. Small industrial plants maintaining a cafeteria and/or showers and club houses or motels maintaining swimming pools and/or laundries are typical examples of multiple uses. Uses other than those listed above shall be considered in relation to established demands from known or similar installations.

(b) or 250 gpd per pump,

(c) 20 x {Water Area ($Ft^2$) / 30} + Deck Area ($Ft^2$)

## (3) Estimated Outdoor Use.

In the absence of firm water use data, Table 510-3 shall be used to estimate the peak day demand and average yearly demand for outdoor water use. The following procedure shall be used:

***Guidance: The demand on drinking water sources is related to whether the system supplies water for outdoor use such as the irrigation of lawns and gardens. While the indoor use of water can be expected to remain relatively constant throughout the state, the outdoor use component is highly variable through the year, and is related to the amount of land irrigated as well as local climatological conditions.***

(a) Determine the location of the water system on the map entitled Irrigated Crop Consumptive Use Zones and Normal Annual Effective Precipitation, Utah as prepared by the Soil Conservation Service (available from the Division). Find the numbered zone, one through six, in which the water system is located (if located in an area described "non-arable" find nearest numbered zone).

***Guidance: The irrigation zone map is provided below. If you are viewing a printed copy of this rule, the map may be in black and white. A more usable colored version of the map may be viewed or downloaded from:***

***http://drinkingwater.utah.gov/irrigation_map_intro.htm***

***Tip: If you are viewing an electronic version of this rule, to make the map more readable use any zoom-in feature which may be available***

(b) Determine the net number of acres which may be irrigated. This is generally done by starting with the gross acreage, then subtract out any area of roadway, driveway, sidewalk or patio pavements along with housing foundation footprints that can be reasonably expected for lots within a new subdivision or which is representative of existing lots. Before any other land area which may be considered "non-irrigated" (e.g. steep slopes, wooded areas, etc.) is subtracted from the gross area, the Division shall be consulted and agree that the land in question will not be irrigated.

***Guidance: For instance, in the case of a heavily wooded mountain home subdivision, it may be claimed that large lawns will not be put in by the lot owners. The division must review and concur with this judgement.***

(c) Refer to Table 510-3 to determine peak day demand and average yearly demand for outdoor use.

(d) The results of the indoor use and outdoor use tables shall be added together and source(s) shall be legally and physically capable of meeting this combined demand.

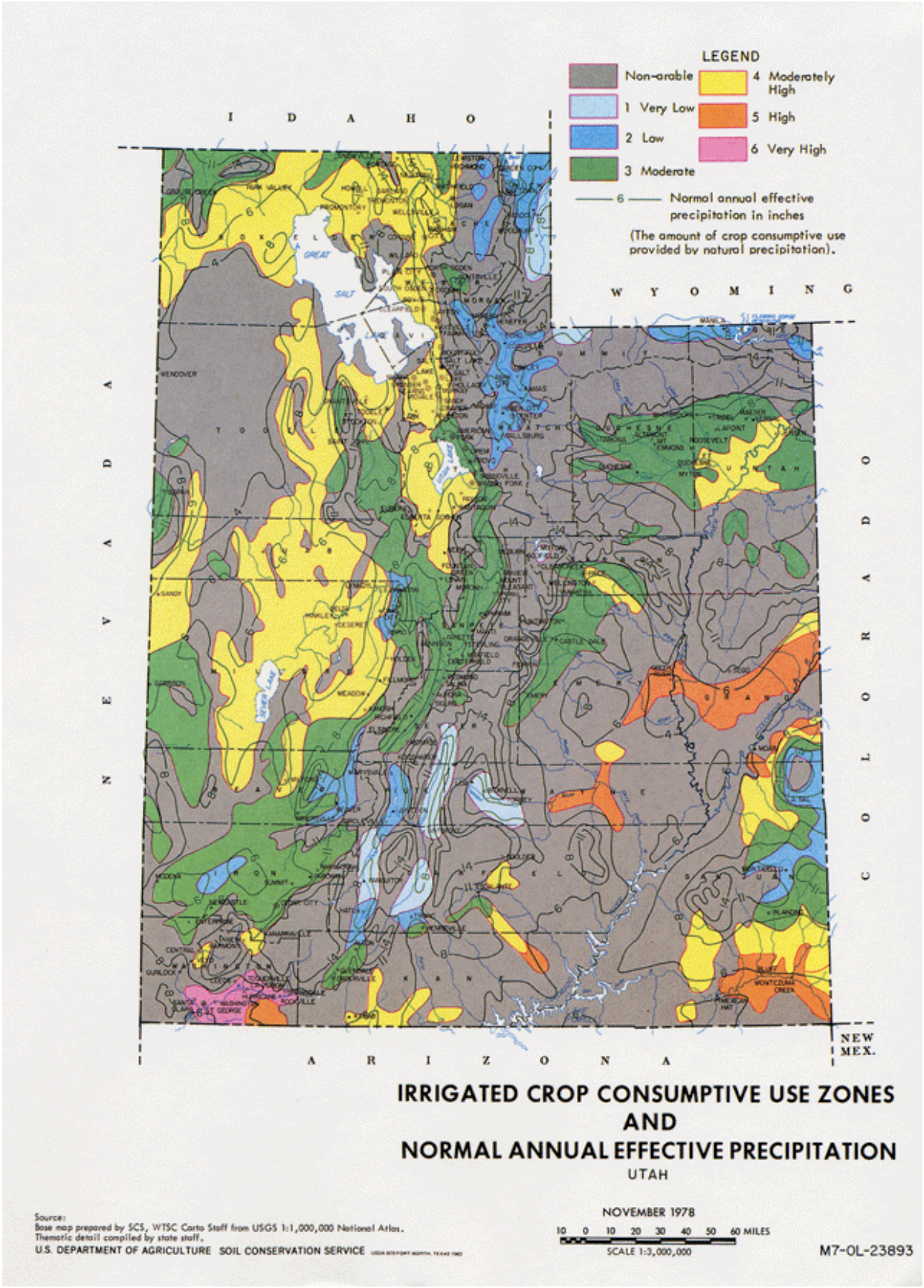
**Table 510-3**
**Source Demand for Irrigation**
**(Outdoor Use)**

| Map Zone | Peak Day Demand (gpm/irrigated acre) | Average Yearly Demand (AF/ irrigated acre) |
|---|---|---|
| 1 | 2.26 | 1.17 |
| 2 | 2.80 | 1.23 |
| 3 | 3.39 | 1.66 |
| 4 | 3.96 | 1.87 |
| 5 | 4.52 | 2.69 |
| 6 | 4.90 | 3.26 |

## (4) Accounting for Variations in Source Yield.

The design engineer shall consider whether flow from the source(s) may vary. Where flow varies, as is the case for most springs, the minimum flowrate shall be used in determining the number of connections which may be supported by the source(s). Where historical records are sufficient, and where peak flows from the source(s) correspond with peak demand periods, the Executive Secretary may grant an exception to this requirement.

***Guidance: The design engineer is cautioned to thoroughly investigate spring behavior. During dry periods, springs (particularly those at higher elevations) may drastically decrease* in flow. *In assessing minimum flowrates of springs, watersheds should be assumed to have received only 80% of normal precipitation***.


LEGEND
Non-arable
1 Very Low
2 Low
3 Moderate
4 Moderately High
5 High
6 Very High
6 Normal annual effective precipitation in inches
(The amount of crop consumptive use provided by natural precipitation).
I D A H O
W Y O M I N G
N E V A D A
C O L O R A D O
A R I Z O N A
NEW MEX.
IRRIGATED CROP CONSUMPTIVE USE ZONES
AND
NORMAL ANNUAL EFFECTIVE PRECIPITATION
UTAH
NOVEMBER 1978
10 0 10 20 30 40 50 60 MILES
SCALE 1:3,000,000
Source:
Base map prepared by SCS, WTSC Carto Staff from USGS 1:1,000,000 National Atlas.
Thematic detail compiled by state staff.
U.S. DEPARTMENT OF AGRICULTURE SOIL CONSERVATION SERVICE
M7-0L-23893

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## *R309-510-8. Storage Sizing.*

### (1) General.

Each storage facility shall provide:

(a) equalization storage volume, to satisfy peak day demands for water for indoor use as well as outdoor use,

(b) fire suppression storage volume, if the water system is equipped with fire hydrants and intended to provide fire fighting water, and

(c) emergency storage, if deemed appropriate by the water supplier or the Executive Secretary, to meet demands in the event of an unexpected emergency situation such as a line break or a treatment plant failures.

### (2) Equalization Storage.

(a) All public drinking water systems shall be provided with equalization storage. The amount of equalization storage which must be provided varies with the nature of the water system, the extent of outdoor use and the location of the system.

(b) Required equalization storage for indoor use is provided in Table 510-4. Storage requirements for non-community systems which are not listed in this table shall be determined by calculating the average day demands from the information given in Table 510-2.

**Table 510-4**
**Storage Volume for Indoor Use**

| Type | Volume Required (gallons) |
|---|---|
| Community Systems | |
| Residential; per single resident service connection | 400 |
| Non-Residential; per Equivalent Residential Connection (ERC) | 400 |

| Non-Community Systems | |
|---|---|
| Modern Recreation Camp; per person | 30 |
| Semi-Developed Camp; per person<br>a. with Pit Privies<br>b. with Flush Toilets | <br>2.5<br>10 |
| Hotel, Motel, & Resorts; per unit | 75 |
| Labor Camp; per unit | 25 |
| Recreational Vehicle Park; per pad | 50 |
| Roadway Rest Stop; per vehicle | 3.5 |
| Recreational Home Development; per connection | 400 |

(c) Where the drinking water system provides water for outdoor use, such as the irrigation of lawns and gardens, the equalization storage volumes estimated in Table 510-5 shall be added to the indoor volumes estimated in Table 510-4. The procedure for determining the map zone and irrigated acreage for using Table 510-5 is outlined in Section R309-510-7(3).

**Table 510-5**
**Storage Volume for Outdoor Use**

| Map Zone | Volume Required (gallons/irrigated acre) |
|---|---|
| 1 | 1,782 |
| 2 | 1,873 |
| 3 | 2,528 |
| 4 | 2,848 |
| 5 | 4,081 |
| 6 | 4,964 |

### (3) Fire Suppression Storage.

Fire suppression storage shall be required if the water system is intended to provide fire fighting water as evidenced by fire hydrants connected to the piping. The design engineer shall consult with the local fire suppression authority regarding needed fire flows in the area under consideration. This information shall be provided to the Division. Where no local fire suppression authority exists, needed fire suppression storage shall be assumed to be 120,000 gallons (1000 gpm for 2 hours).

***Guidance: The 1991 Uniform Fire Code has been adopted statewide in Utah. However, local authorities are authorized to deviate from this code if it can be justified. Normal fire storage volume is given in Table A-III-A-1 of the code. According to this table, flow duration must be 2 to 4 hours depending on the size and type of structure which must be protected. Fire flow storage for a one or two family dwelling of less than 3,600 square feet would be 120,000 gallons (1,000 gpm x 120 minutes).Larger volumes would be required for other structures.***

### (4) Emergency Storage.

Emergency storage shall be considered during the design process. The amount of emergency storage shall be based upon an assessment of risk and the desired degree of system dependability. The Executive Secretary may require emergency storage when it is warranted to protect public health and welfare.

***Guidance: It is advisable to provide water storage for emergency situations, such as pipeline failures, major trunk main failures, equipment failures, electrical power outages, water treatment facility failures, raw-water supply contamination, or natural disasters. Generally, the need for emergency storage shall be determined by the water supplier and design engineer.***

## *R309-510-9. Distribution System Sizing.*

### (1) General Requirements.

The distribution system shall be designed to insure that a minimum of 20 psi exists at all points within the system during peak instantaneous demand conditions. If the distribution system is equipped with fire hydrants, the system shall be designed to insure that a minimum of 20 psi exists at all points within the system when needed fire flows are imposed upon the peak day demand flows of the system.

### (2) Indoor Use, Estimated Peak Instantaneous Demand.

(a) For community water systems and large non-community systems, the peak instantaneous demand for each pipeline shall be assumed for indoor use as:

$$Q = 10.8 \times N^{0.64}$$

where N equals the total number of ERC's, and Q equals the total flow (gpm) delivered to the total connections served by that pipeline.

For Recreational Vehicle Parks, the peak instantaneous flow for indoor use shall be based on the following:

**Table 510-6**
**Peak Instantaneous Demand for Recreational Vehicle Parks**

| Number of Connections | Formula |
|---|---|
| 0 to 59 | Q=4N |
| 60 to 239 | $Q= 80+ 20N^{0.5}$ |
| 240 or greater | Q= 1.6N |

**NOTE FOR TABLE 510-6:**

Q is total peak instantaneous demand (gpm) and N is the maximum number of connections. However, if the only water use is via service buildings the peak instantaneous demand shall be calculated for the number of fixture units as presented in Appendix E of the 2000 International Plumbing Code.

(b) For small non-community water systems the peak instantaneous demand to be estimated for indoor use shall be calculated on a per-building basis for the number of fixture units as presented in Appendix E of the 2000 International Plumbing Code.

## (3) Outdoor Use, Estimated Peak Instantaneous Demand.

Peak instantaneous demand to be estimated for outdoor use is given in Table 510-7. The procedure for determining the map zone and irrigated acreage for using Table 510-7 is outlined in Section R309-510-7(3).

| Table 510-7<br>Peak Instantaneous Demand for Outdoor Use | |
|---|---|
| Map Zone | Peak Instantaneous Demand (gpm/irrigated acre) |
| 1 | 4.52 |
| 2 | 5.60 |
| 3 | 6.78 |
| 4 | 7.92 |
| 5 | 9.04 |
| 6 | 9.80 |

## (4) Fire Flows.

(a) Distribution systems shall be designed to deliver needed fire flows if fire hydrants are provided. The design engineer shall consult with the local fire suppression authority regarding needed fire flows in the area under consideration. This information shall be provided to the Division. Where no local fire suppression authority exists, needed fire flows shall be assumed to be 1000 gpm.

***Guidance: Generally, fire flows shall be as required by Table A-III-A-1 of the 1991 Uniform Fire Code. According to this table, minimum fire flow for a one or two family dwelling not exceeding 3,600 square* feet is *1,000 gpm. Fire flows for other types of buildings are higher. Then1991 Uniform Fire Code has been adopted statewide in Utah. However, local authorities are authorized to deviate from this code if it can be justified.***

(b) If a distribution system is equipped with fire hydrants, the system shall be designed to insure that a minimum of 20 psi exists at all points within the system when fire flows are added to the peak day demand of the system. Refer to Section R309-510-7 for information on determining the peak day demand of the system.

**KEY:**
drinking water, minimum sizing, water conservation

**Date of Enactment or Last Substantive Amendment**
August 15, 2001

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**Authorizing Implemented or Interpreted Law**
19-4-104

**DDW Version**
Revised 2/12/03

# R309-204 Source Development (Effective January 1, 1998)

**Note: The Division of Drinking Water is currently revising rules. Because of this, some of the references to rule numbers outside of this document may be invalid. Note also that this rule will eventually be rewritten as R309-515.**

## Table of Contents

# R309-204 Source Development

## *R309-204-1. Purpose*

This rule specifies requirements for public drinking water sources. It is intended to be applied in conjunction with R309-201 through R309-211. Collectively, these rules govern the design, construction, operation and maintenance of public drinking water system facilities. These rules are intended to assure that such facilities are reliably capable of supplying adequate quantities of water which consistently meet applicable drinking water quality requirements and do not pose a threat to general public health.

## *R309-204-2. Authority*

This rule is promulgated by the Drinking Water Board as authorized by Title 19, Environmental Quality Code, Chapter 4, Safe Drinking Water Act, Subsection 104(1)(a)(ii) of the Utah Code Annotated and in accordance with 63-46a of the same, known as the Administrative Rulemaking Act.

## *R309-204-3. Definitions*

Definitions for certain terms used in this rule are given in R309-200.

## *R309-204-4. General*

### (1) Issues to be Considered.

The selection, development and operation of a public drinking water source must be done in a manner which will protect public health and assure that all required water quality standards, as described in R309-103, are met.

***Guidance: Among the issues which should be considered before source selection and any preparation of development plans are the following:***

***(a) The source should be analyzed to determine if it would be considered a surface water source or a ground water source. Surface water sources must be given "conventional surface water treatment" to help assure microbiological safety (see R309-206). True groundwater sources ordinarily require only disinfection to help assure microbiological safety (see R309-103-2.7).***

***(b) The vulnerability of the source to current and future contamination and how the source will be protected from chemical, radiological or microbial pollution. (see R309-113).***

***(c) The presence of natural chemical and radiological contaminants may not allow the source to be used as a culinary source. (see MCL's in R309-103).***

***(d) The source must be able to meet the demands of the system both physically and legally. (see R309-203-7).***

## (2) Communication with the Division

Because of the issues described above in (1), engineers are advised to work closely with the Division to help assure that sources are properly sited, developed and operated.

## (3) Number of Sources and Quantity Requirement

Community water systems established after January 1, 1998 serving more than 100 connections shall have a minimum of two sources, except where served by a water treatment plant. Community Water Systems established prior to that date, currently serving more than 100 connections, shall obtain a separate source no later than January 1, 2000. For all systems, the total developed source capacity(ies) shall equal or exceed the peak day demand of the system. Refer to R309-203-5 of these rules for procedure to estimate the peak day demand.

## (4) Quality Requirements.

In selecting a source of water for development, the designing engineer shall demonstrate to the satisfaction of the Executive Secretary that the source(s) selected for use in public water systems are of satisfactory quality, or can be treated in a manner so that the quality requirements of R309-103 can be met.

## (5) Initial Analyses

All new drinking water sources, unless otherwise noted below, shall be analyzed for the following:

(a) All the primary and secondary inorganic contaminants listed in R309-103, Table 103-1 and Table 103-5 (excluding Asbestos unless it would be required by R309-104-4.1.2),

(b) Ammonia as N; Boron; Calcium; Chromium, Hex as Cr; Copper; Lead; Magnesium; Potassium; Turbidity, as NTU; Specific Conductivity at 25 degrees Celsius, u mhos/cm; Bicarbonate; Carbon Dioxide; Carbonate; Hydroxide; Phosphorous, Ortho as P; Silica, dissolved as $SiO_2$; Surfactant as MBAS; Total Hardness as $CaCO_3$; and Alkalinity as $CaCO_3$,

(c) Pesticides, PCB's and SOC's as listed in R309-103-2.3a, Table 103-2 unless the system is a transient non-community pws or, if a community pws or non-transient non-community pws, they have received waivers in accordance with R309-104-4.3.1f. The following six constituents have been excused from monitoring in the State by the EPA, dibromochloropropane, ethylene dibromide, Diquat, Endothall, glyphosate and Dioxin,

(d) VOC's as listed in R309-103-2.3b, Table 103-3 unless the system is a transient non-community pws, and

(e) Radiologic chemicals as listed in R309-103-2.4 unless the system is a non-transient non-community pws or a transient non-community pws.

(f) Unregulated contaminants as listed in R309-104-5.1.1 list A and list B, unless a transient non-community pws.

All analyses shall be performed by a certified laboratory as required by R309-104-3 (Specially prepared sample bottles are required),

## (6) Source Classification

Subsection R309-202-7(1)(a)(i) provides information on the classification of water sources. The Executive Secretary shall classify all existing or new sources as either:

(a) Surface water or ground water under direct influence of surface water which will require conventional surface water treatment or an approved equivalent, or as

(b) Ground water not under the direct influence of surface water.

## (7) Latitude and Longitude

The latitude and longitude, to at least the nearest second, or the location by section, township, range, and course and distance from an established outside section corner or quarter corner of each point of diversion shall be submitted to the Executive Secretary prior to source approval.

## *R309-204-5. Surface Water Sources*

### (1) Definition

A surface water source, as is defined in R309-200, shall include, but not be limited to tributary systems, drainage basins, natural lakes, artificial reservoirs, impoundments and springs or wells which have been classified as being directly influenced by surface water. Surface water sources will not be considered for culinary use unless they can be rendered acceptable by conventional surface water treatment or other equivalent treatment techniques acceptable to the Executive Secretary.

### (2) Pre-design Submittal

The following information must be submitted to the Executive Secretary and approved in writing before commencement of design of diversion structures and/or water treatment facilities:

(a) A copy of the chemical analyses required by R309-103 and described in R309-204-4(5) above, and

(b) A survey of the watershed tributary to the watercourse along which diversion structures are proposed. The survey shall include, but not be limited to:

(i) determining possible future uses of impoundments or reservoirs,

(ii) the present stream classification by the Division of Water Quality, any obstacles to having stream(s) reclassified 1C, and determining degree of watershed control by owner or other agencies,

(iii) assessing degree of hazard to the supply by accidental spillage of materials that may be toxic, harmful or detrimental to treatment processes,

(iv) obtaining samples over a sufficient period of time to assess the microbiological, physical, chemical and radiological characteristics and variations of the water,

(v) assessing the capability of the proposed treatment process to reduce contaminants to applicable standards, and

(vi) consideration of currents, wind and ice conditions, and the effect of tributary streams at their confluence.

## (3) Pre-construction Submittal

Following approval of a surface water source, the following additional information must be submitted for review and approval prior to commencement of construction:

(a) Evidence that the water system owner has a legal right to divert water from the proposed source for domestic or municipal purposes;

(b) Documentation regarding the minimum firm yield which the watercourse is capable of producing (see R309-204-5(4)(a) below; and

(c) Complete plans and specifications and supporting documentation for the proposed treatment facilities so as to ascertain compliance with R309-206 or R309-207.

## (4) Quantity

The quantity of water from surface sources shall:

(a) Be assumed to be no greater than the low flow of a 25 year recurrence interval or the low flow of record for these sources when 25 years of records are not available;

(b) Meet or exceed the anticipated peak day demand for water as estimated in R309-203-7 and provide a reasonable surplus for anticipated growth; and

(c) Be adequate to compensate for all losses such as silting, evaporation, seepage, and sludge disposal which would be anticipated in the normal operation of the treatment facility.

## (5) Diversion Structures

Design of intake structures shall provide for:

(a) Withdrawal of water from more than one level if quality varies with depth;

(b) Intake of lowest withdrawal elevation located at sufficient depth to be kept submerged at the low water elevation of the reservoir;

(c) Separate facilities for release of less desirable water held in storage;

(d) Occasional cleaning of the inlet line;

(e) A diversion device capable of keeping large quantities of fish or debris from entering an intake structure; and

(f) Suitable protection of pumps where used to transfer diverted water (refer to R309-209-5).

### (6) Impoundments

The design of an impoundment reservoir shall provide for, where applicable:

(a) Removal of brush and trees to the high water level;

(b) Protection from floods during construction;

(c) Abandonment of all wells which may be inundated (refer to applicable requirements of the Division of Water Rights); and

(d) Adequate precautions to limit nutrient loads.

## *R309-204-6. Ground Water - Wells.*

### (1) Required Treatment

If properly developed, water from wells may be suitable for culinary use without treatment. A determination as to whether treatment may be required can only be made after the source has been developed and evaluated.

### (2) Standby Power

Water suppliers, particularly community water suppliers, should assess the capability of their system in the event of a power outage. If gravity fed spring sources are not available, one or more of the system's well sources should be equipped for operation during power outages. In this event:

(a) To ensure continuous service when the primary power has been interrupted, a power supply should be provided through connection to at least two independent public power sources, or portable or in-place auxiliary power available as an alternative; and

(b) When automatic pre-lubrication of pump bearings is necessary, and an auxiliary power supply is provided, the pre-lubrication line should be provided

with a valved by-pass around the automatic control, or the automatic control shall be wired to the emergency power source.

## (3) The Utah Division of Water Rights

The Utah Division of Water Rights (State Engineer's Office) regulates the drilling of water wells. Before the drilling of a well commences, the well driller must receive a start card from the State Engineer's Office.

***Guidance: The Administrative Rules for Water Well Drillers, adopted January 19, 1995 should be consulted for additional well drilling information. The engineer and driller should be aware that requirements governing the design of public drinking water wells, as described herein, are generally more strict than requirements of the State Engineer's Office .***

## (4) Source Protection

Public drinking water systems are responsible for protecting their sources from contamination. The selection of a well location shall only be made after consideration of the requirements of R309-113. Sources shall be located in an area which will minimize threats from existing or potential sources of pollution.
If certain precautions are taken, sewer lines may be permitted within a public drinking water system's source protection zones at the discretion of the Executive Secretary. When sewer lines are permitted in protection zones both sewer lines and manholes shall be specially constructed as follows:

(a) sewer lines shall be ductile iron pipe with mechanical joints or fusion welded high density polyethylene plastic pipe ( solvent welded joints shall not be accepted);

(b) lateral to main connection shall be shop fabricated or saddled with a mechanical clamping watertight device designed for the specific pipe;

(c) the sewer pipe to manhole connections shall made using a shop fabricated sewer pipe seal ring cast into the manhole base (a mechanical joint shall be installed within 12 inches of the manhole base on each line entering the manhole, regardless of the pipe material);

(d) the sewer pipe shall be laid with no greater than 2 percent deflection at any joint;

(e) backfill shall be compacted to not less than 95 percent of maximum laboratory density as determined in accordance with ASTM Standard D-690;

(f) sewer manholes shall meet the following requirements:

(i) the manhole base and walls, up to a point at least 12 inches above the top of the upper most sewer pipe entering the manhole, shall be shop fabricated in a single concrete pour.

(ii) the manholes shall be constructed of reinforced concrete.

(iii) all sewer lines and manholes shall be air pressure tested after installation.

## (5) Outline of Well Approval Process.

(a) Well drilling shall not commence until both of the following items are submitted and receive a favorable review:

(i) a Preliminary Evaluation Report on source protection issues as required by R309-113-13(2), and

(ii) engineering plans and specifications governing the well drilling.

(b) Grouting Inspection During Well Construction.

An engineer from the Division, or the appropriate district engineer of the Department of Environmental Quality, or an authorized representative of the State Engineer's Office shall be contacted at least three days before the anticipated beginning of the well grouting procedure (see R309-204-6(6)(i)). The well grouting procedure shall be witnessed by one of these individuals or their designee.

(c) After completion of the well drilling the following information shall be submitted and receive a favorable review before water from the well can be introduced into a public water system:

(i) a copy of the "Report of Well Driller" as required by the State Engineer's Office which is complete in all aspects and has been stamped as received by the same;

(ii) a copy of the letter from the engineer described in R309-204-6(5)(b) above, indicating inspection and certification that the well was grouted in accordance with the well drilling specifications and the requirements of this rule;

(iii) a copy of the pump test including the yield vs. drawdown test as described in R309-204-6(10)(b);

(iv) a copy of the chemical analyses required by R309-204-4(5);

***Guidance: In order for the levels of analytes to be representative of the aquifer and reduce the chance that turbidity will exceed the ground water limit, the samples for the analysis should be collected after the well has been continuously pumped for 24 hours.***

(v) documentation indicating that the water system owner has a right to divert water for domestic or municipal purposes from the well source;

(vi) a copy of complete plans and specifications covering the well equipment and diversion piping necessary to introduce the water from the well into the distribution system; and

(vii) a bacteriological analysis of water obtained from the well after installation of permanent equipment, disinfection and flushing.

(d) An Operation Permit shall be obtained in accordance with R309-201-9 before any water from the well is introduced into a public water system.

## (6) Well Materials, Design and Construction

**(a) ANSI/NSF Standards 60 and 61 Certification.**

All interior surfaces must consist of products complying with ANSI/NSF Standard 61. This requirement applies to casings, drop pipes, well screens, coatings, adhesives, solders, fluxes, pumps, switches, electrical wire, sensors, and all other equipment or surfaces which may be contact the drinking water.

All substances introduced into the well during construction or development shall be certified to comply with ANSI/NSF Standard 60. This requirement applies to drilling fluids (biocides, clay thinners, defoamers, foamers, loss circulation materials, lubricants, oxygen scavengers, viscosifiers, weighting agents) and regenerants. This requirement also applies to well grouting and sealing materials which may come in direct contact with the drinking water.

**(b) Permanent Steel Casing Pipe shall:**

(i) be new single steel casing pipe meeting AWWA Standard A-100, ASTM or API specifications and having a minimum weight and thickness as given in Table 1 found in R655-4-7.2 of the Utah Administrative Code (Administrative Rules for Water Well Drillers, adopted January 19, 1995, Division of Water Rights);

(ii) have additional thickness and weight if minimum thickness is not considered sufficient to assure reasonable life expectancy of the well;

(iii) be capable of withstanding forces to which it is subjected;

(iv) be equipped with a drive shoe when driven;

(v) have full circumferential welds or threaded coupling joints; and

(vi) project at least 18 inches above the anticipated final ground surface and at least 12 inches above the anticipated pump house floor level. At sites subject to flooding the top of the well casing shall terminate at least three feet above the 100 year flood level or the highest known flood elevation, whichever is higher.

**(c) Non-Ferrous Casing Material.**

The use of any non-ferrous material for a well casing shall receive prior approval of the Executive Secretary based on the ability of the material to perform its desired function. Thermoplastic water well casing pipe shall meet ANSI/ASTM Standard F480-76 and shall bear the logo NSF-wc indicating compliance with NSF Standard 14 for use as well casing.

**(d) Disposal of Cuttings.**

Cuttings and waste from well drilling operations shall not be discharged into a waterway, lake or reservoir. The rules of the Utah Division of Water Quality must be observed with respect to these discharges.

**(e) Packers.**

Packers, if used, shall be of material that will not impart taste, odor, toxic substances or bacterial contamination to the well water. Lead, or partial lead packers are specifically prohibited.

**(f) Screens.**

The use of well screens is recommended where appropriate and, if used, they shall:

(i) be constructed of material resistant to damage by chemical action of groundwater or cleaning operations;

(ii) have size of openings based on sieve analysis of formations or gravel pack materials;

(iii) have sufficient diameter to provide adequate specific capacity and low aperature entrance velocities;

***Guidance:*** *Usually the entrance velocities should not exceed 0.1 fps.*

(iv) be installed so that the operating water level remains above the screen under all pumping conditions; and

(v) be provided with a bottom plate or washdown bottom fitting of the same material as the screen.

**(g) Plumbness and Alignment Requirements**

Every well shall be tested for plumbness and vertical alignment in accordance with AWWA Standard A100. Plans and specifications submitted for review shall:

(i) have the test method and allowable tolerances clearly stated in the specifications. and

(ii) clearly indicate any options the design engineer may have if the well fails to meet the requirements. Generally wells may be accepted if the misalignment does not interfere with the installation or operation of the pump or uniform placement of grout.

**(h) Casing Perforations.**

The placement of perforations in the well casing shall:

(i) be so located to permit as far as practical the uniform collection of water around the circumference of the well casing, and

(ii) be of dimensions and size to restrain the water bearing soils from entrance into the well.

**(i) Grouting Techniques and Requirements.**

All permanent well casing for public drinking water wells shall be grouted to a depth of at least 100 feet below the ground surface unless an "exception" is issued by the Executive Secretary (see R309-102-2.2).

***Guidance: This is required in order to prevent the seepage of undesirable surface or shallow ground water along the casing into the water bearing aquifer.***

If a well is to be considered in a protected aquifer the grout seal shall extend from the ground surface down to at least 100 feet below the surface, and through the protective layer, as described in R309-113-6(1)(v).

The following applies to all drinking water wells:

(i) Consideration During Well Construction.

(A) Sufficient annular opening shall be provided to permit a minimum of two inches of grout between the permanent casing and the drilled hole, taking into consideration any joint couplings. If a carrier casing is left in place, the minimum clearances above shall pertain to both annular openings (between casings and between carrier casing and the drilled hole), the carrier casing shall be adequately perforated (minimum six slots _" x 3" at one foot intervals) so as to ensure grout contact with the native formations, and the carrier casing shall, if possible, be withdrawn at least five feet during grouting operations.

(B) Additional information is available from the Division for recommended construction methods for grout placement.

(C) The casing(s) must be provided with sufficient guides welded to the casing to permit unobstructed flow and uniform thickness of grout.

(ii) Grouting Materials.

(A) Neat Cement Grout.

Cement, conforming to ASTM Standard C150, and water, with no more than six gallons of water per sack of cement, shall be used for two inch openings. Additives may be used to increase fluidity subject to approval by the Executive Secretary.

(B) Concrete Grout.

Equal parts of cement conforming to ASTM Standard C150, and sand, with not more than six gallons of water per sack of cement may be used for openings larger than two inches.

(C) Clay Seal.

Where an annular opening greater than six inches is available a clay seal of clean local clay mixed with at least ten percent

swelling bentonite may be used when approved by the Executive Secretary.

(iii) Application.

(A) When the annular opening is less than four inches, grout shall be installed under pressure, by means of a positive displacement grout pump, from the bottom of the annular opening to be filled.

(B) When the annular opening is four or more inches and 100 feet or less in depth, and concrete grout is used, it may be placed by gravity through a grout pipe installed to the bottom of the annular opening in one continuous operation until the annular opening is filled.

(C) All temporary construction casings should be removed but shall be withdrawn at least five feet during the grouting operation to ensure grout contact with the native formations.

(D) When a "well in a protected aquifer" classification is desired, the grout seal shall extend from the ground surface down to at least 100 feet below the surface, and through the protective clay layer (see R309-113-6(1)(v)). If the clay layer starts below 100 feet, grout shall extend from the ground surface to a depth of at least 100 feet, grout or native fill may be utilized from there to the top of the clay layer, and then grout placed completely through the protective clay layer. If the clay layer starts and ends above 100 feet, grout shall extend from the ground surface down to and completely through the protective clay layer.

(E) After cement grouting is applied, work on the well shall be discontinued until the cement or concrete grout has properly set; usually a period of 72 hours.

**(j) Water Entered Into Well During Construction.**

Any water entering a well during construction shall not be contaminated and should be obtained from a chlorinated municipal system. Where this is not possible the water must be dosed to give a 100 mg/l free chlorine residual. Refer also to the administrative rules of the Division of Water Rights in this regard.

**(k) Gravel Pack Wells.**

The following shall apply to gravel packed wells:

(i) the gravel pack material is to be of well rounded particles, 95 percent siliceous material, that are smooth and uniform, free of foreign material, properly sized, washed and then disinfected immediately prior to or during placement,

(ii) the gravel pack is placed in one uniform continuous operation,

(iii) refill pipes, when used, are Schedule 40 steel pipe incorporated within the pump foundation and terminated with screwed or welded caps at least 12 inches above the pump house floor or concrete apron,

(iv) refill pipes located in the grouted annular opening be surrounded by a minimum of 1.5 inches of grout,

(v) protection provided to prevent leakage of grout into the gravel pack or screen, and

(vi) any casings not withdrawn entirely meet requirements of R309-204-6(6)(b) or R309-204-6(6)(c).

## (7) Well Development

(a) Every well shall be developed to remove the native silts and clays, drilling mud or finer fraction of the gravel pack.

(b) Development should continue until the maximum specific capacity is obtained from the completed well.

(c) Where chemical conditioning is required, the specifications shall include provisions for the method, equipment, chemicals, testing for residual chemicals, and disposal of waste and inhibitors.

(d) Where blasting procedures may be used the specifications shall include the provisions for blasting and cleaning. Special attention shall be given to assure that the grouting and casing are not damaged by the blasting.

## (8) Capping Requirements

(a) A welded metal plate or a threaded cap is the preferred method for capping a well.

(b) At all times during the progress of work the contractor shall provide protection to prevent tampering with the well or entrance of foreign materials.

## (9) Well Abandonment

(a) Test wells and groundwater sources which are to be permanently abandoned shall be sealed by such methods as necessary to restore the controlling geological conditions which existed prior to construction or as directed by the Utah Division of Water Rights.

(b) Wells to be abandoned shall be sealed to prevent undesirable exchange of water from one aquifer to another. Preference shall be given to using a neat cement grout. Where fill materials are used, which are other than cement grout or concrete, they shall be disinfected and free of foreign materials. When an abandoned well is filled with cement-grout or concrete, these materials shall be applied to the well-hole through a pipe, tremie, or bailer.

## (10) Well Assessment

**(a) Step Drawdown Test.**

Preliminary to the constant-rate test required below, it is recommended that a step-drawdown test (uniform increases in pumping rates over uniform time intervals with single drawdown measurements taken at the end of the intervals) be conducted to determine the maximum pumping rate for the desired intake setting.

**(b) Constant-Rate Test.**

A "constant-rate" yield and drawdown test shall:

(i) be performed on every production well after construction or subsequent treatment and prior to placement of the permanent pump,

(ii) have the test methods clearly indicated in the specifications,

(iii) have a test pump with sufficient capacity that when pumped against the maximum anticipated drawdown, it will be capable of pumping at least 1.5 times the desired design discharge rate,

(iv) provide for continuous pumping for at least 24 hours or until stabilized drawdown has continued for at least six hours when test pumped at a "constant-rate" equal to 1.5 times the desired design discharge rate,

(v) provide the following data:

(A) capacity vs. head characteristics for the test pump (manufacturer's pump curve),

(B) static water level (in feet to the nearest tenth, as measured from an identified datum; usually the top of casing),

(C) depth of test pump intake,

(D) time and date of starting and ending test(s),

***Guidance: It is recommended to monitor any existing wells in the area during the pump test to perform a more useful aquifer test and determine if there will be interference from other wells.***

(vi) For the "constant-rate" test provide the following at time intervals sufficient for at least ten essentially uniform intervals for each log cycle of the graphic evaluation required below:

(A) record the time since starting test (in minutes),

(B) record the actual pumping rate,

(C) record the pumping water level (in feet to the nearest tenth, as measured from the same datum used for the static water level),

(D) record the drawdown (pumping water level minus static water level in feet to the nearest tenth),

(E) provide graphic evaluation on semilogarithmic graph paper by plotting the drawdown measurements on the arithmetic scale at locations corresponding to time since starting test on the logarithmic scale, and

(vii) Immediately after termination of the constant-rate test, and for a period of time until there are no changes in depth to water level measurements for at least six hours, record the following at time intervals similar to those used during the constant-rate pump test:

(A) time since stopping pump test (in minutes),

(B) depth to water level (in feet to the nearest tenth, as measured from the same datum used for the pumping water level).

## (11) Well Disinfection.

Every new, modified, or reconditioned well including pumping equipment shall be disinfected before being placed into service for drinking water use. These shall be

disinfected according to AWWA Standard C654 published by the American Water Works Association as modified to incorporate the following as a minimum standard:

(a) the well shall be disinfected with a chlorine solution of sufficient volume and strength and so applied that a concentration of at least 50 parts per million is obtained in all parts of the well and comes in contact with equipment installed in the well. This solution shall remain in the well for a period of at least eight hours, and

(b) a satisfactory bacteriologic water sample analysis shall be obtained prior to the use of water from the well in a public water system.

## (12) Well Equipping

### (a) Naturally Flowing Wells

Naturally flowing wells shall:

(i) have the discharge controlled by valves,

(ii) be provided with permanent casing and sealed by grout,

(iii) if erosion of the confining bed adjacent to the well appears likely, special protective construction may be required by the Division.

### (b) Line Shaft Pumps.

Wells equipped with line shaft pumps shall:

(i) have the casing firmly connected to the pump structure or have the casing inserted into the recess extending at least 0.5 inches into the pump base,

(ii) have the pump foundation and base designed to prevent fluids from coming into contact with joints between the pump base and the casing,

(iii) be designed such that the intake of the well pump is at least ten feet below the maximum anticipated drawdown elevation,

(iv) avoid the use of oil lubrication for pumps with intake screens set at depths less than 400 feet (see R309-102-4.7 for additional requirements of lubricants).

### (c) Submersible Pumps.

Where a submersible pump is used:

(i) The top of the casing shall be effectively sealed against the entrance of water under all conditions of vibration or movement of conductors or cables.

(ii) The electrical cable shall be firmly attached to the riser pipe at 20 foot intervals or less.

(iv) The intake of the well pump must be at least ten feet below the maximum anticipated drawdown elevation.

**(d) Pitless Well Units and Adapters.**

Pitless well units and adapters shall:

(i) not be used unless the specific application has been approved by the Executive Secretary,

(ii) terminate at least 18 inches above final ground elevation or three feet above the highest known flood elevation whichever is greater,

(iii) be approved by NSF International or the Pitless Adapter Association or other appropriate Review Authority,

(iv) have suitable access to the interior of the casing in order to disinfect the well,

(v) have a suitable sanitary seal or cover at the upper terminal of the casing that will prevent the entrance of any fluids or contamination, especially at the connection point of the electrical cables,

(vi) have suitable access so that measurements of static and pumped water levels in the well can be obtained,

(vii) allow at least one check valve within the well casing,

(viii) be furnished with a cover that is lockable or otherwise protected against vandalism or sabotage,

(ix) be shop-fabricated from the point of connection with the well casing to the unit cap or cover,

(x) be of watertight construction throughout,

(xi) be constructed of materials at least equivalent to and having wall thickness compatible to the casing,

(xii) have field connection to the lateral discharge from the pitless unit of threaded, flanged or mechanical joint connection,

(xiii) be threaded or welded to the well casing. If the connection to the casing is by field weld, the shop assembled unit must be designed specifically for field welding to the casing. The only field welding permitted on the pitless unit will be that needed to connect a pitless unit to the casing, and

(xiv) have an inside diameter as great as that of the well casing, up to and including casing diameters of 12 inches, to facilitate work and repair on the well, pump, or well screen.

**(e) Well Discharge Piping**

The discharge piping shall:

(i) be designed so that the friction loss will be low,

(ii) have control valves and appurtenances located above the pump house floor when an above-ground discharge is provided,

(iii) be protected against the entrance of contamination,

(iv) be equipped with (in order of placement from the well head) a smooth nosed sampling tap, a check valve, a pressure gauge, a means of measuring flow and a shutoff valve,

(v) where a well pumps directly into a distribution system, be equipped with an air release vacuum relief valve located upstream from the check valve, with exhaust/relief piping terminating in a down-turned position at least six inches above the floor and covered with a No. 14 mesh corrosion resistant screen. An exception to this requirement will be allowed provided specific proposed well head valve and piping design includes provisions for pumping to waste all trapped air before water is introduced into the distribution system,

(vi) have all exposed piping valves and appurtenances protected against physical damage and freezing,

(vii) be properly anchored to prevent movement, and

(viii) be protected against surge or water hammer.

***Guidance: The discharge piping should be provided with a means of pumping to waste, but shall not be directly connected to a sewer. The discharge end of the pump-to-waste line shall be covered with No. 4 mesh corrosion resistant screen (refer to R309-210-10(1)).***

***Guidance: Provisions should be made for venting the well casing to atmosphere, particularly if a large or sudden water drawdown is expected. The vent shall terminate in a down turned position, at or above the top of the casing or pitless unit in a minimum 1.5 inch diameter opening covered with a No. 14 mesh, corrosion resistant screen (refer to section R309-210-15). The pipe connecting the casing to the vent shall be of adequate size to provide rapid venting of the casing.***

**(f) Water Level Measurement**

(i) Provisions shall be made to permit periodic measurement of water levels in the completed well.

(ii) Where permanent water level measuring equipment is installed it shall be made using corrosion resistant materials attached firmly to the drop pipe or pump column and installed in such a manner as to prevent entrance of foreign materials.

**(g) Observation Wells.**

Observation wells shall be:

(i) constructed in accordance with the requirements for permanent wells if they are to remain in service after completion of a water supply well, and

(ii) protected at the upper terminal to preclude entrance of foreign materials.

**(h) Electrical Protection.**

Sufficient electrical controls shall be placed on all pump motors to eliminate electrical problems due to phase shifts, surges, lightning, etc.

## (13) Well House Construction

The use of a well house is strongly recommended, particularly in installations utilizing above ground motors.

In addition to applicable provisions of R309-209, well pump houses shall conform to the following:

**(a) Casing Projection Above Floor.**

The permanent casing for all ground water wells shall project at least 12 inches above the pump house floor or concrete apron surface and at least 18 inches above the final ground surface. However, casings terminated in underground vaults may be permitted if the vault is provided with a drain to daylight sized to handle in excess of the well flow and surface runoff is directed away from the vault access.

**(b) Floor Drain.**

Where a well house is constructed the floor surface shall be at least six inches above the final ground elevation and shall be sloped to provide drainage. A "drain-to-daylight" shall be provided unless highly impractical.

**(c) Earth Berm.**

Sites subject to flooding shall be provided with an earth berm terminating at an elevation at least two feet above the highest known flood elevation or other suitable protection as determined by the Executive Secretary.

**(d) Well Casing Termination at Flood Sites.**

The top of the well casing at sites subject to flooding shall terminate at least 3 feet above the 100 year flood level or the highest known flood elevation, whichever is higher (refer to R309-204-6(6)(b)(vi)).

**(e) Miscellaneous.**

The well house shall be ventilated, heated and lighted in such a manner as to assure adequate protection of the equipment (refer to R309-209-5(2) (a) through (h)

**(f) Fencing.**

Where necessary to protect the quality of the well water the Executive Secretary may require that certain wells be fenced in a manner similar to fencing required around spring areas.

**(g) Access.**

An access shall be provided either through the well house roof or sidewalls in the event the pump must be pulled for replacement or servicing the well.

## *R309-204-7. Ground Water – Springs*

### (1) General

Springs vary greatly in their characteristics and they should be observed for some time prior to development to determine any flow and quality variations. Springs determined to be "under the direct influence of surface water" will have to be given "surface water treatment".

### (2) Source Protection

Public drinking water systems are responsible for protecting their spring sources from contamination. The selection of a spring should only be made after consideration of the requirements of R309-204-4. Springs must be located in an area which shall minimize threats from existing or potential sources of pollution. A Preliminary Evaluation Report on source protection issues is required by R309-113-13(2). If certain precautions are taken, sewer lines may be permitted within a public drinking water system's source protection zones at the discretion of the Executive Secretary. When sewer lines are permitted in protection zones both sewer lines and manholes shall be specially constructed as described in R309-204-6(4).

### (3) Surface Water Influence

Some springs yield water which has been filtered underground for years, other springs yield water which has been filtered underground only a matter of hours. Even with proper development, the untreated water from certain springs may exhibit turbidity and high coliform counts. This indicates that the spring water is not being sufficiently filtered in underground travel. If a spring is determined to be "under the direct influence of surface water", it shall be given "conventional surface water treatment" (refer to R309-202-6).

### (4) Pre-construction Submittal

Before commencement of construction of spring development improvements the following information must be submitted to the Executive Secretary and approved in writing.

(a) Detailed plans and specifications covering the development work.

(b) A copy of an engineer's statement indicating:

(i) the historical record (if available) of spring flow variation,

(ii) expected minimum flow and the time of year it will occur,

(iii) expected maximum flow and the time of year it will occur,

(iv) expected average flow,

(v) the behavior of the spring during drought conditions.

After evaluating this information, the Division will assign a "firm yield" for the spring which will be used in assessing the number of and type of connections which can be served by the spring (see "desired design discharge rate" in R309-200).

(c) A copy of documentation indicating the water system owner has a right to divert water for domestic or municipal purposes from the spring source.

(d) A Preliminary Evaluation Report on source protection issues as required by R309-113-13(1).

***Guidance: The public water system management and the design engineer should refer to R309-202-7(1), especially the frequent monitoring described in subsection (a)(i)(B), before considering a spring as a source for a public water system.***

(e) A copy of the chemical analyses required by R309-204-4(5).

(f) An assessment of whether the spring is "under the direct influence of surface water" (refer to R309-202-7(1)(a)(i).

## (5) Information Required after Spring Development

After development of a culinary spring, the following information shall be submitted:

(a) Proof of satisfactory bacteriologic quality.

(b) Information on the rate of flow developed from the spring.

(c) As-built plans of spring development.

## (6) Operation Permit Required

Water from the spring can be introduced into a public water system only after it has been approved for use, in writing, by the Executive Secretary.

## (7) Spring Development

The development of springs for drinking water purposes shall comply with the following requirements:

(a) The spring collection device, whether it be collection tile, perforated pipe, imported gravel, infiltration boxes or tunnels must be covered with a minimum of ten feet of relatively impervious soil cover. Such cover must extend a minimum of 15 feet in all horizontal directions from the spring collection device. Clean, inert, non-organic material shall be placed in the vicinity of the collection device(s).

(b) Where it is impossible to achieve the ten feet of relatively impervious soil cover, an acceptable alternate will be the use of an impermeable liner provided that:

(i) the liner has a minimum thickness of at least 10 mils,

(ii) all seams in the liner are folded or welded to prevent leakage,

(iii) the liner is certified as complying with ANSI/NSF Standard 61. This requirement is waived if certain that the drinking water will not contact the liner,

(iv) the liner is installed in such a manner as to assure its integrity. No stones, two inch or larger or sharp edged, shall be located within two inches of the liner,

(v) a minimum of two feet of relatively impervious soil cover is placed over the impermeable liner,

(vi) the soil and liner cover are extended a minimum of 15 feet in all horizontal directions from the collection devices.

(c) Each spring collection area shall be provided with at least one collection box to permit spring inspection and testing.

(d) All junction boxes and collection boxes, must comply with R309-210-14 with respect to access manholes, air vents, and overflow piping. Lids for these spring boxes shall be gasketed and the box adequately vented.

(e) The spring collection area shall be surrounded by a fence located a distance of 50 feet (preferably 100 feet if conditions allow) from all collection devices on land at an elevation equal to or higher than the collection device, and a distance of 15 feet from all collection devices on land at an elevation lower than the collection device. The elevation datum to be used is the surface elevation at the point of collection. The fence shall be at least "stock tight" (see R309-200). In remote areas where no grazing or public access is possible, the fencing requirement may be waived by the Executive Secretary. In populated areas a six foot high chain link fence with three strands of barbed wire may be required.

(f) Within the fenced area all vegetation which has a deep root system shall be removed.

(g) A diversion channel, or berm, capable of diverting all anticipated surface water runoff away from the spring collection area shall be constructed immediately inside the fenced area.

(h) A permanent flow measuring device shall be installed. Flow measurement devices such as critical depth meters or weirs shall be properly housed and otherwise protected.

(i) The spring shall be developed as thoroughly as possible so as to minimize the possibility of excess spring water ponding within the collection area. Where the ponding of spring water is unavoidable, the excess shall be collected by shallow piping or french drain and be routed beyond and down grade of the fenced area required above, whether or not a fence is in place.

## *R309-204-8. Operation and Maintenance.*

### (1) Spring Collection Area Maintenance

(a) Spring collection areas shall be periodically (preferably annually) cleared of deep rooted vegetation to prevent root growth from clogging collection lines. Frequent hand or mechanical clearing of spring collection areas and diversion channel is strongly recommended. It is advantageous to encourage the growth of grasses and other shallow rooted vegetation for erosion control and to inhibit the growth of more detrimental flora.

(b) No pesticide (e.g., herbicide) may be applied on a spring collection area without the prior written approval of the Executive Secretary. Such approval shall be given 1) only when acceptable pesticides are proposed; 2) when the pesticide product manufacturer certifies that no harmful substance will be

imparted to the water; and 3) only when spring development construction meets the requirements of these rules.

## (2) Pump Lubricants

The U.S. Food and Drug Administration (FDA) has approved propylene glycol and certain types of mineral oil for occasional contact with or for addition to food products. These oils are commonly referred to as "food-grade mineral oils". All oil lubricated pumps shall utilize food grade mineral oil suitable for human consumption as determined by the Executive Secretary.

***Guidance: To assure proper performance, and to prevent the voiding of any warranties which may be in force, the water supplier should confirm with individual pump manufacturers that the oil which is selected will have the necessary properties to perform satisfactorily.***

## (3) Algicide Treatment

No algicide shall be applied to a drinking water source unless specific approval is obtained from the Division. Such approval will be given only if the algicide is certified as meeting the requirements of ANSI/NSF Standard 60, Water Treatment Chemicals - Health Effects.

# R309-520 Disinfection (Effective August 15, 2000)

## Table of Contents

# R309-520. Facility Design and Operation: Disinfection.

## *R309-520-1. Purpose.*

This rule specifies requirements for facilities which disinfect public drinking water. It is intended to be applied in conjunction with R309-500 through R309-550. Collectively, these rules govern the design, construction, operation and maintenance of public drinking water system facilities. These rules are intended to assure that such facilities are reliably capable of supplying adequate quantities of water which consistently meet applicable drinking water quality requirements and do not pose a threat to general public health.

## *R309-520-2. Authority.*

This rule is promulgated by the Drinking Water Board as authorized by Title 19, Environmental Quality Code, Chapter 4, Safe Drinking Water Act, Subsection 104(1)(a)(ii) of the Utah Code and in accordance with Title 63, Chapter 46a of the same, known as the Administrative Rulemaking Act.

## *R309-520-3. Definitions.*

Definitions for certain terms used in this rule are given in R309-110 but may be further clarified herein.

## *R309-520-4. General.*

Continuous disinfection shall be required of all ground water sources not consistently meeting standards of bacterio logic quality. Surface water sources or ground water sources under direct influence of surface water shall be disinfected during the course of required conventional surface water treatment or alternative surface water treatment. Disinfection shall not be considered a substitute for inadequate collection facilities. Systems having only sources classified as ground water (see R309-202-8) and which disinfect shall meet the requirements of R309-102-4.1.

## *R309-520-5. Allowable Primary Disinfectants.*

Primary disinfection is defined as the means for providing adequate levels of inactivation of pathogenic micro organisms within the treatment process. Its effectiveness is measured through the "CT" values. Only three disinfectants; chlorine (gaseous and liquid hypochlorites), ozone, and chlorine dioxide are allowable for primary disinfection.

## *R309-520-6. Allowable Secondary Disinfectants.*

Secondary disinfection is intended to provide an adequate disinfectant residual in the distribution system to maintain the bacteriological quality of treated water. Its effectiveness is measured through maintaining a detectable disinfectant residual throughout the distribution system. Allowable disinfectants are chlorine (gaseous and liquid hypochlorites), chloramine, and chlorine dioxide.

## *R309-520-7. Appropriate Uses of Chemical Disinfectants.*

Chemical disinfection alone is appropriate only for groundwater not under the influence of surface water. Surface water, or groundwater under the direct influence of surface water, shall be coagulated and filtered in addition to being disinfected. For criteria to be used in determining required levels of treatment refer to R309-103-2.7.

## *R309-520-8. Required Chemical Dosing and Contact Time.*

Minimum levels for primary and secondary disinfection are specified in R309-103-2.7.

## *R309-520-9. Siting.*

Disinfection installations shall be sited to permit convenient access through the entire year as well as considerations of safety (i.e. proximity to population or seismic fault zones).

## *R309-520-10. Chlorine.*

### (1) General Requirements for all Chlorination Installations.

**(a) Chemical Types.**

Disinfection by chlorination shall be accomplished by gaseous chlorine or liquid solutions of calcium or sodium hypochlorites.

**(b) Feeding Equipment.**

Solution-feed gas type chlorinators, direct-feed gas type chlorinators or hypochlorite liquid feeders of a positive displacement type shall be provided. Solution-feed gas type chlorinators are preferred. However, for small supplies requiring less than four pounds per day, liquid hypochlorinators are advised.

**(c) Chlorine Feed Capacity.**

The design of each chlorinator shall permit:

(i) the chlorinator capacity to be such that a free chlorine residual of at least 2 mg/l can be maintained in the system after 30 minutes of contact time during peak demand. The equipment shall be of such design that it will operate accurately over a feeding range of 0.2 mg/l to 2 mg/l.

(ii) assurance that a detectable residual, either combined or free, can be maintained at all times, at all points in the distribution system.

**(d) Automatic Proportioning.**

Automatic proportioning chlorinators shall be required where the rate of flow or chlorine demand is not reasonably constant.

**(e) Injector/diffuser.**

The chlorine solution injector/diffuser shall be compatible with the point of application to provide a rapid and thorough mix with all the water being treated. The center of a pipeline is the preferred application point.

**(f) Contact Time and Point of Application.**

(i) Due consideration shall be given to the contact time of the chlorine in water with relation to pH, ammonia, taste producing substances, temperature, biological quality, and other pertinent factors.

***Guidance: Chlorine should be applied at a point which will provide the maximum contact time and mixing.***

(ii) Where possible, the design shall minimize the formation of chloro-organic compounds. At plants treating surface water or ground water under the direct influence of surface water, provisions shall be made for applying chlorine to raw water, applied water, filtered water, and water entering the distribution system.

(iii) When treating ground water, provisions shall be made for applying chlorine to at least a reservoir inlet or transmission pipeline which will provide maximum contact time.

(iv) Care must be taken to assure that the point of application will, in conjunction with the pipe and tank configuration of the water system, allow required CT values to be achieved prior to the first consumer connection.

**(g) Minimization of Chlorinated Overflow.**

The chlorinator and associated water delivery facilities shall be designed so as to minimize the unnecessary release of chlorinated water into the environment from tank overflows (see also rules of Division of Water Quality pertaining to discharge or pollution).

**(h) Chlorinator Piping.**

The chlorinator water supply piping shall be designed to prevent contamination of the treated water supply by sources of questionable quality. At all facilities treating surface water, pre- and post-chlorination systems shall be independent where solution water is not finished water. All chlorinator solution water shall be at least of equal quality to the water receiving the chlorine solution.

**(i) Water Measurement.**

A means to measure water flow to be treated shall be provided.

**(j) Residual Testing Equipment.**

Chlorine residual test equipment recognized in the latest edition of "Standard Methods for the Examination of Water and Wastewater" shall be provided and shall be capable of measuring residuals to the nearest 0.1 mg/l in the range below 0.5 mg/l, to the nearest 0.3 mg/l between 0.5 mg/l and 1.0 mg/l and to the nearest 0.5 mg/l above 1.0 mg/l.

***Guidance: Automatic chlorine residual recorders should be provided where the chlorine demand varies appreciably over a short period of time. The N,N-Diethyl-p-phenylendiamine (DPD) method of chlorine residual determination is recommended. Information on the suppliers of this equipment is available from the Division.***

## (k) Standby and Backup Equipment.

A spare parts kit shall be provided and maintained for all chlorinators to repair parts subject to wear and breakage. If there is a large difference in feed rates between routine and emergency dosages, a gas metering tube shall be provided for each dose range to ensure accurate control of the chlorine feed. Where chlorination is required for protection of the supply, standby equipment of sufficient capacity shall be available to replace the largest unit. Standby power shall be available, during power outages, for operation of chlorinators where protection of the supply is required.

**(l) Heating, Lighting, Ventilation.**

Chlorinator houses shall be heated, lighted and ventilated as necessary to assure proper operation of the equipment, and serviceability.

**(m) Bypass Capability.**

A chlorinator bypass shall be provided for periods during chlorinator servicing and power outages.

## (2) Additional Requirement for Gas Chlorinators.

**(a) Automatic Switch over.**

Automatic Switch over of chlorine cylinders shall be provided, where necessary, to assure continuous disinfection.

**(b) Injector.**

Each injector shall be selected for the point of application with particular attention given to the quantity of chlorine to be added, the maximum injector waterflow, the total discharge back pressure, the injector operating pressure, and the size of the chlorine solution line. Gauges for measuring water pressure at the inlet and outlet of each injector shall be provided.

**(c) Gas Scrubbers.**

Gas chlorine facilities shall conform with the Uniform Fire Code, Article 80 and the Uniform Building Code, Chapter 9 as they are applied by local jurisdictions in the state. Furthermore, local toxic gas ordinances shall be complied with if they exist.

**(d) Heat.**

The design of the chlorination room shall assure that the temperature in the room will never fall below 32 degrees F or that temperature required for proper operation of the chlorinator, whichever is greater.

***Guidance: Chlorinator rooms should be heated to 50 degrees F, and be protected from excessive heat. Where space heaters are used, the cylinders should be protected from direct heat. Care must be taken to avoid chlorine condensation in feed lines caused by the feed equipment being cooler than the chlorine cylinder.***

**(e) Ventilation.**

Chlorination equipment rooms which contain cylinders or equipment and lines with gaseous chlorine under pressure shall be vented such that:

(i) when fan(s) are operating, suction will provide one complete room air change per minute;

(ii) the ventilating fan(s) take suction near the floor, as far as practical from the door and air inlet, with the point of discharge so located as not to contaminate air inlets of any rooms or structures;

(iii) air inlets are through louvers near the ceiling;

(iv) louvers for chlorine room air intake and exhaust facilitate airtight closure;

(iv) separate switches for the fans and lights are outside of the room, at the entrance to the chlorination equipment room. Outside switches shall be protected from vandalism;

***Guidance: For chlorinators which lack proper security, switches may be located just inside the door. A signal light indicating fan operation should be provided at each entrance when the fan can be controlled from more than one point.***

(v) vents from feeders and storage discharge above grade to the outside atmosphere; and

(vi) floor drains are discouraged. Where provided, the floor drains shall discharge to the outside of the building and shall not be connected to other internal or external drainage systems.

**(f) Feeder Vent Hose.**

The vent hose from the feeder shall discharge to the outside atmosphere above grade at a point least susceptible to vandalism and shall have the end covered with a No. 14 mesh non-corrodible screen.

**(g) Housing.**

Adequate housing shall be provided for the chlorination equipment and for storing the chlorine (see R309-520-10(1)(l) above).

**(h) Housing at Water Treatment Plants.**

Separate rooms for cylinders and feed equipment shall be provided at all water treatment plants. Chlorine gas feed and storage shall be enclosed and separated from other operating areas. The chlorine room shall be:

(i) provided with a shatter resistant inspection window installed in an interior wall and preferably located so that an operator may read the weighing scales without entering the chlorine room,

(ii) constructed in a manner that all openings between the chlorine room and the remainder of the plant are sealed, and

(iii) provided with doors equipped with panic hardware assuring ready means of exit and opening only to the building exterior.

***Guidance: The room location should be on the prevailing downwind side of the building away from entrances, windows, louvers, walkways, etc.***

**(i) Cylinder Security.**

Full and empty cylinders of chlorine gas shall be:

(i) isolated from operating areas;

(ii) restrained in position to prevent upset from accidental bumping or a seismic event;

(iii) stored in rooms separated from ammonia storage; and

(iv) stored in areas not in direct sunlight or exposed to excessive heat.

**(j) Feed Line Routing.**

Chlorine feed lines shall not carry pressurized chlorine gas beyond the chlorinator room. Only vacuum lines may be routed to other portions of the building outside the chlorine room and any openings for these lines must be adequately sealed.

**(k) Weighing Scales.**

Scales shall be provided for weighing cylinders. Scales should be of a corrosion resistant material and should be placed in a location remote from any moisture. Scales shall be accurate enough to indicate loss of weight to the nearest one pound for 150 pound cylinders and to the nearest 10 pounds for one ton cylinders.

**(l) Pressure Gauges.**

Pressure gauges shall be provided on the inlet and outlet of each chlorine injector as indicated in R309-520-10(2)(b). The preferred location is on the water feed line immediately before the inlet of the chlorine injector and at a point on the water main just ahead of chlorine injection. These locations should give accurate pressure readings while not being subjected to corrosive chlorinated water.

**(m) Injector Protection.**

A suitable screen to prevent small debris from clogging a chlorine injector shall be provided on the water feed line. Provision for flushing of the screen is required.

**(n) Chlorine Vent Line Protection.**

A non-corrodible fine mesh (No. 14 or finer) screen shall be placed over the discharge ends of all vent lines. All vent lines shall discharge to the outside atmosphere above grade and at locations least susceptible to vandalism.

**(o) Gas Masks.**

(i) Respiratory protection equipment, meeting the requirements of the National Institute for Occupational Safety and Health (NIOSH) shall be available where chlorine gas in one-ton cylinders is handled, and shall be stored at a convenient location, but not inside any room where chlorine is used or stored. The units shall use compressed air, have at least a 30 minute capacity, and be compatible with or exactly the same as units used by the fire department responsible for the plant.

(ii) Where smaller chlorine cylinders are used, suitable gas masks must be provided.

**(p) Chlorine Leak Detection and Repair.**

A bottle of Ammonium Hydroxide, 56% ammonia solution, shall be available for chlorine leak detection; where ton containers are used, a leak repair kit approved by the Chlorine Institute shall be provided. Continuous chlorine leak detection equipment is recommended. Where a leak detector is provided, it shall be equipped with both an audible alarm and a warning light.

## *R309-520-11. Ozone.*

Proposals for use of ozone disinfection shall be discussed with the Division prior to the preparation of final plans and specifications.

Interim Standard - Ozonation, page xxxi, in the Recommended Standards for Water Works (commonly known as "Ten State Standards"), 1997 edition is hereby incorporated by reference

and shall govern the design and operation of disinfection facilities utilizing ozone. This document is published by the Great Lakes-Upper Mississippi River Board of Public Health and Environmental Managers. A copy is available in the office of the Division for reference.

## *R309-520-12. Chlorine Dioxide.*

Proposals for the use of Chlorine Dioxide as a disinfectant shall be discussed with the Division prior to the preparation of final plans and specifications. The "CT" values for the inactivation of Giardia cysts using chlorine dioxide are independent of pH, with only temperature affecting the value. For chlorine dioxide, a 3-log inactivation of Giardia cysts will generally result in greater than 4-log virus inactivation, and assure meeting requirements. However, for chlorine dioxide, unlike chlorine where this relationship always hold true, at certain temperatures, the 4-log virus CT may be higher than the 3-log Giardia cyst CT.

## *R309-520-13. Chloramines.*

Proposals for the use of Chloramines as a disinfectant shall be discussed with the Division prior to the preparation of final plans and specifications.

***Guidance: Chloramines are a much weaker oxidant than free chlorine, ozone or chlorine dioxide and therefore the "CT" values for inactivation of Giardia cysts by chloramines are extremely high and may not be achievable for some systems. Chloramines may be utilized only for secondary disinfection, as necessary to maintain required disinfectant residual concentrations in water entering, or throughout, the distribution system. Chlorine may be added prior to ammonia in producing chloramines, or ammonia prior to chlorine, or even ammonia and chlorine added concurrently. The order of application of chlorine and ammonia to form chloramines is important and source waters must be evaluated to determine which method is most effective.***

## *R309-520-14. Ultraviolet Light.*

(1) Proposals for use of ultraviolet disinfection shall be discussed with the Division prior to the preparation of final plans and specifications.

(2) Secondary disinfection and maintenance of the required residual will be necessary where disinfection of the supply is required.

(3) Ultraviolet disinfection will be permitted where the design conforms to the minimum recommendations of the U.S. Public Health Service listed below.

(a) Ultraviolet radiation at a level of 2,537 Angstrom units must be applied at a minimum dosage of 16,000 microwatt-seconds per square centimeter per second (1,600 Finsen Units) at all points throughout the water disinfection chamber.

(b) Maximum water depth in the chamber, measured from the tub surface to the chamber wall, shall not exceed three inches.

(c) The ultraviolet tubes shall be:

(i) jacketed so that a proper operating tube temperature of about 105 degrees F is maintained; and

(ii) the jacket shall be of quartz or high silica glass with similar optical characteristics.

(d) A flow or time delay mechanism shall be provided to permit a two minute tube warm-up period before water flows from the unit.

(e) The unit shall be designed to permit frequent mechanical cleaning of the water contact surface of the jacket without disassembly of the unit.

(f) An automatic flow control valve, accurate within the expected pressure range, shall be installed to restrict flow to the maximum design flow of the treatment unit.

(g) An accurately calibrated ultraviolet intensity meter, properly filtered to restrict its sensitivity to the disinfection spectrum, shall be installed in the wall of the disinfection chamber at the point of greatest water depth from the tube or tubes.

(h) A diversion valve or automatic shut-off valve shall be installed which will permit flow into the finished drinking water system only when at least the minimum ultraviolet dosage is applied. When power is not being supplied to the unit, the valve should be in a closed position which prevents the flow of water into the finished drinking water system.

(i) An automatic, audible alarm shall be installed to warn of malfunction or impending shutdown.

(j) The materials of construction shall not impart toxic materials into the water either as a result of the presence of toxic constituents in materials of construction or as a result of physical or chemical changes resulting from exposure to ultraviolet energy.

(k) The unit shall be designed to protect the operator against electrical shock or excessive radiation.

(l) As with any drinking water treatment process, due consideration must be given to the reliability, economics, and competent operation of the disinfection process and related equipment, including:

(i) installation of the unit in a protected enclosure not subject to extremes of temperature which could cause malfunction; and

(ii) provision of a spare UV tube and other necessary equipment to effect prompt repair by qualified personnel properly instructed in the operation and maintenance of the equipment.

## *R309-520-15. Operation and Maintenance.*

### (1) Safety.

Chlorine gas facilities shall be operated in a manner which minimizes risks to water system personnel or the general public.

***Guidance: The following environmental rules relate to the transportation and handling of chlorine gas and should be incorporated into operation and maintenance procedures:***

***(a) Emergency Planning and Community Right-To-Know Act (EPCRA) under the Superfund Amendment and Reauthorization Act (SARA) Title III of 1986***
***(b) Hazardous Material Transportaion Uniform Safety Act (HMTUSA) of 1990 and Revisions of 1992***
***(c) Uniform Fire Code (UFC) Article 80***
***(d) Uniform Building Code (UBC) Chapter 9***
***(e) Clean Air Act Amendments (CAAA) of 1990***
***(f) Process Safety Management of Highly Hazardous Chemicals, enacted by the Occupational Safety and Health Administration in May 1992.***

### (2) Residual Chlorine.

Public drinking water systems supplied water from conventional surface water treatment or alternatives shall test for detectable chlorine residual or HPC within the distribution system as outlined in R309-104-4.7.4c.

***Guidance: Minimum free chlorine residual at distant points in a water distribtuion system should be 0.2 to 0.5 mg/l. Combined chlorine residuals, if appropriate, should be 1.0 to 2.0 mg/ l at distant points in the distribution system.***

## (3) Chlorine Dosing.

Chlorine, when used in the distribution system, shall be added in sufficient quantity to achieve either "breakpoint" and yield a detectable free chlorine residual or a detectable combined chlorine residual in the distribution system at points to be determined by the Executive Secretary. Residual checks must be taken daily by the operator of any system using disinfectants. The Executive Secretary may, however, reduce the frequency of residual checks if he determines that this would be an unwarranted hardship on the water system operator and, furthermore, the disinfection equipment has a verified record of reliable operation. Suppliers, when checking for residuals, must use test kits and methods which meet the requirements of the U.S. EPA. The "DPD" test method is recommended for free chlorine residuals. Information on the suppliers of this equipment is available from the Division.

## (4) ANSI/NSF Standard 60 Certification.

All chemicals, including chlorine gas, added to drinking water supplied by a public water system shall be certified as complying with ANSI/NSF Standard 60, Drinking Water Treatment Chemicals.

**KEY: drinking water, primary disinfectants, secondary disinfectants, operation and maintenance**

**August 15, 2000** **19-4-104**

# R309-525. Conventional Surface Water Treatment (Effective December 9, 2002

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# R309-525. Conventional Surface Water Treatment.

## *R309-525-1. Purpose.*

This rule specifies requirements for conventional surface water treatment plants used in public water systems. It is intended to be applied in conjunction with rules R309-500 through R309-550. Collectively, these rules govern the design, construction, operation and maintenance of public drinking water system facilities. These rules are intended to assure that such facilities are reliably capable of supplying adequate quantities of water which consistently meet applicable drinking water quality requirements and do not pose a threat to general public health.

## *R309-525-2. Authority.*

This rule is promulgated by the Drinking Water Board as authorized by Title 19, Environmental Quality Code, Chapter 4, Safe Drinking Water Act, Subsection 104(1)(a)(ii) of the Utah Code and in accordance with 63-46a of the same, known as the Administrative Rulemaking Act.

## *R309-525-3. Definitions.*

Definitions for certain terms used in this rule are given in R309-110 but may be further clarified herein.

## *R309-525-4. General.*

(1) Treatment plants used for the purification of surface water supplies or ground water supplies under direct influence of surface water must conform to the requirements given herein. The plants shall have, as a minimum, facilities for flash mixing of coagulant chemicals, flocculation, sedimentation, filtration and disinfection.

(2) The overall design of a water treatment facility must be carefully examined to assure the compatibility of all devices and processes. The design of treatment processes and devices shall depend on an evaluation of the nature and quality of the particular water to be treated. The combined unit processes shall produce water meeting all established drinking water standards as given in R309-200.

(3) Direct filtration may be acceptable and rules governing this method are given in R309-530-5.

(4) Refer to R309-530-9 for policy with regards to novel water treatment equipment or techniques which may depart from the requirements outlined herein.

## *R309-525-5. Plant Capacity and Number of Treatment Trains.*

(1) A determination of the required plant capacity and the required number of treatment trains shall be made after consultation with the Division. Ordinarily, a minimum of two units each for flocculation, sedimentation and filtration must be provided. The design shall provide for parallel or series operation of the clarification stages. Flash mix shall be designed and operated to provide a minimum velocity gradient of 750 fps/ft. Mixing time shall be less than thirty seconds. The treatment plant shall be designed to meet the anticipated "peak day demand" of the system being served when the treatment plant is the system's sole source. When other sources are available to the system, this requirement may be relaxed.

(2) The degree of "back-up" required in a water treatment plant will vary with the number of connections to be served, the availability of other acceptable sources of water, and the ability to control water consumption. Thus, when other sources are available to the system, the requirements of R309-525-7 (Plant Reliability) may also be relaxed. The Division shall be consulted in this regard prior to plant design.

## *R309-525-6. Plant Siting.*

Plants must be sited with due regard for earthquake, flood, and fire hazard. Assistance in this matter is available from the Utah Geologic Survey. The Division shall be consulted regarding site selection prior to the preparation of engineering plans and specifications.

## *R309-525-7. Plant Reliability.*

Plants designed for processing surface water or ground water under direct influence of surface water shall be designed to meet present and future water demands and assure reliable operation at all times. To help assure proper, uninterrupted operation:

(1) A manual override shall be provided for any automatic controls. Highly sophisticated automation may put proper maintenance beyond the capability of the plant operator, leading to equipment breakdowns or expensive servicing. Adequate funding must be assured for maintenance of automatic equipment.

(2) Main switch electrical controls shall be located above grade, in areas not subject to flooding.

(3) Plants shall be operated by qualified personnel approved by the Executive Secretary. As a minimum, the treatment plant manager is required to be certified in accordance with R309-300 at the grade of the waterworks system with an appropriate unrestricted Utah Operator's Certificate.

(4) The plant shall be constructed to permit units to be taken out of service without disrupting operation, and with drains or pumps sized to allow dewatering in a reasonable period of time.

(5) The plant shall have standby power available to permit operation of essential functions during power outages,

(6) The plant shall be provided with backup equipment or necessary spare parts for all critical items.

(7) Individual components critical to the operation of a treatment plant shall be provided with anchorage to secure the components from loss due to an earthquake event.

## *R309-525-8. Color Coding and Pipe Marking.*

The piping in water treatment plants shall be color coded for identification. The following table contains color schemes recommended by the Division. Identification of the direction of flow and the contained liquid shall also be made on the pipe.

**Table 525-1**
**Recommended Color Scheme for Piping**

| | |
|---|---|
| Water Lines | |
| Raw | Olive Green |
| Settled or Clarified | Aquamarine |
| Finished | Dark Blue |
| Chemical Lines | |
| Alum | Orange |
| Ammonia | White |
| Carbon Slurry | Black |
| Chlorine (Gas and Solution) | Yellow |
| Flouride | Light Blue with Red Band |
| Lime Slurry | Light Green |

| | |
|---|---|
| Potassium Permanganate | Violet |
| Sulfur Dioxide | Light Green with Yellow Band |
| Waste Lines | |
| Backwash Waste | Light Brown |
| Sludge | Dark Brown |
| Sewer (Sanitary or Other) | Dark Grey |
| Other Lines | |
| Compressed Air | Dark Green |
| Gas | Red |
| Other Lines | Light Grey |

## *R309-525-9. Diversion Structures and Pretreatment.*

Refer to R309-515-5(5) for diversion structure design.

## *R309-525-10. Presedimentation.*

Waters containing, heavy grit, sand, gravel, leaves, debris, or a large volume of sediments may require pretreatment, usually sedimentation, with or without the addition of coagulation chemicals.

(1) Presedimentation basins shall be equipped for efficient sludge removal.

(2) Incoming water shall be dispersed across the full width of the line of travel as efficiently as practical. Short-circuiting shall be minimized.

(3) Provisions for bypassing presedimentation basins shall be included.

## *R309-525-11. Chemical Addition.*

## (1) Goals.

Chemicals used in the treatment of surface water shall achieve the following:

(a) Primary coagulant chemicals shall be utilized to permit the formation of a floc,

(b) Disinfectants shall be added to raw and/or treated water.

## (2) Application Criteria.

In achieving these goals the chemical(s) shall be applied to the water:

(a) To assure maximum control and flexibility of treatment,

(b) To assure maximum safety to consumer and operators,

(c) To prevent backflow or back-siphonage of chemical solutions to finished water systems.

(d) With appropriate spacing of chemical feed to eliminate any interference between chemicals.

## (3) Typical Chemical Doses.

Chemical doses shall be estimated for each treatment plant to be designed. "Jar tests" shall be conducted on representative raw water samples to determine anticipated doses.

## (4) Information Required for Review.

With respect to chemical applications, a submittal for Division review shall include:

(a) Descriptions of feed equipment, including maximum and minimum feed rates,

(b) Location of feeders, piping layout and points of application,

(c) Chemical storage and handling facilities,

(d) Specifications for chemicals to be used,

(e) Operating and control procedures including proposed application rates,

(f) Descriptions of testing equipment and procedures, and

(g) Results of chemical, physical, biological and other tests performed as necessary to define the optimum chemical treatment.

## (5) Quality of Chemicals.

All chemicals added to water being treated for use in a public water system for human consumption shall comply with ANSI/NSF Standard 60. Evidence for this requirement shall be met if the chemical shipping container labels or material safety data sheets include:

(a) Chemical name, purity and concentrations, Supplier name and address, and

(b) Labeling indicating compliance with ANSI/NSF Standard 60.

***Guidance: Blending and re-packaging of one or more certified chemicals by other than the original chemical supplier may void any laboratory certification and the Executive Secretary may require re-certification of such products before allowing their use.***

## (6) Storage, Safe Handling and Ventilation of Chemicals.

All requirements of the Utah Occupational Safety and Health Act (UOSHA) for storage, safe handling and ventilation of chemicals shall apply to public drinking water facilities. The designer shall incorporate all applicable UOSHA standards into the facility design, however, review of facility plans by the Division of Drinking Water under this Rule shall be limited to the following requirements:

(a) Storage of Chemicals.

(i) Space shall be provided for:

(A) An adequate supply of chemicals,

(B) Convenient and efficient handling of chemicals,

(C) Dry storage conditions.

(ii) Storage tanks and pipelines for liquid chemicals shall be specific to the chemicals and not for alternates.

(iii) Chemicals shall be stored in covered or unopened shipping containers, unless the chemical is transferred into a covered storage unit.

(iv) Liquid chemical storage tanks must:

(A) Have a liquid level indicator, and

(B) Have an overflow and a receiving basin or drain capable of receiving accidental spills or overflows, and meeting all requirements of R309-525-23, and

(C) Be equipped with an inverted "J" air vent.

(v) Acids shall be kept in closed acid-resistant shipping containers or storage units.

(b) Safe Handling.

(i) Material Safety Data Sheets for all chemicals utilized shall be kept and maintained in prominent display and be easily accessed by operators.

(ii) Provisions shall be made for disposing of empty bags, drums or barrels by an acceptable procedure which will minimize operator exposure to dusts.

(iii) Provisions shall be made for measuring quantities of chemicals used to prepare feed solutions.

(c) Dust Control and Ventilation.

Adequate provision shall be made for dust control and ventilation.

## (7) Feeder Design, Location and Control.

**(a) General Feeder Design.**

General equipment design, location and control shall be such that:

(i) feeders shall supply, at all times, the necessary amounts of chemicals at an accurately controlled rate, throughout the anticipated range of feed,

(ii) chemical-contact materials and surfaces are resistant to the aggressiveness of the chemicals,

(iii) corrosive chemicals are introduced in a manner to minimize potential for corrosion,

(iv) chemicals that are incompatible are not fed, stored or handled together.

***Guidance: Facilities should be such that chemicals can be located in a room separate from the main plant in order to reduce hazards and dust problems***

(v) all chemicals are conducted from the feeder to the point of application in separate conduits,

(vi) spare parts are available for all feeders to replace parts which are subject to wear and damage,

(vii) chemical feeders are as near as practical to the feed point,

(viii) chemical feeders and pumps operate at no lower than 20 percent of the feed range,

(ix) chemicals are fed by gravity where practical,

(x) be readily accessible for servicing, repair, and observation.

**(b) Chemical Feed Equipment.**

Where chemical feed is necessary for the protection of the consumer, such as disinfection, coagulation or other essential processes:

(i) a minimum of two feeders, one active and one standby, shall be provided for each chemical,

(ii) the standby unit or a combination of units of sufficient capacity shall be available to replace the largest unit during shut-downs,

(iii) where a booster pump is required, duplicate equipment shall be provided and, when necessary, standby power,

(iv) a separate feeder shall be used for each non-compatible chemical applied where a feed pump is required, and

Guidance: If a common feeder is used for compatible chemicals such as alum and ferric, provisions should be made for flushing the lines and pumps prior to changing chemical.

(v) spare parts shall be available for all feeders to replace parts which are subject to wear and damage.

**(c) Dry Chemical Feeders.**

Dry chemical feeders shall:

(i) measure feed rate of chemicals volumetrically or gravimetrically, and

(ii) provide adequate solution water and agitation of the chemical in the solution tank.

**(d) Feed Rate Control**

(i) Feeders may be manually or automatically controlled, with automatic controls being designed to allow override by manual controls.

(ii) Chemical feed rates shall be proportional to flows.

(iii) A means to measure water flow rate shall be provided.

(iv) Provisions shall be made for measuring the quantities of chemicals used.

(v) Weighing scales:

(A) shall be provided for weighing cylinders at all plants using chlorine gas,

(B) may be required for fluoride solution feed, where applicable,

(C) shall be provided for volumetric dry chemical feeders, and

(D) shall be accurate to measure increments of 0.5 percent of scale capacity.

## (8) Feeder Appurtenances.

**(a) Liquid Chemical Solution Pumps.**

Positive displacement type solution feed pumps shall be used to feed liquid chemicals, but shall not be used to feed chemical slurries. Pumps must be sized to match or exceed maximum head conditions found at the point of injection. All liquid chemical feeders shall be provided with devices approved by the Utah Plumbing Code which will prevent the siphoning of liquid chemical through the pump.

**(b) Solution Tanks.**

(i) A means consistent with the nature of the chemical solution shall be provided in a solution tank to maintain a uniform strength of solution. Continuous agitation shall be provided to maintain slurries in suspension.

Guidance: Two solution tanks of adequate volume may be required for a chemical to assure continuity of supply while servicing a solution tank.

(ii) Means shall be provided to measure the solution level in the tank.

(iii) Chemical solutions shall be kept covered. Large tanks with access openings shall have the openings curbed and fitted with tight overhanging covers.

(iv) Subsurface locations are discouraged, but when used for solution tanks shall:

(A) be free from sources of possible contamination, and

(B) assure positive drainage for ground waters, accumulated water, chemical spills and overflows.

(v) Overflow pipes, when provided, shall:

(A) have a free fall discharge, and

(B) be located where noticeable.

(vi) Acid storage tanks shall be vented to the outside atmosphere, but not through vents in common with day tanks.

(vii) Each tank shall be provided with a valved drain, protected against backflow in accordance with R309-525-11(10)(b) and R309-525-11(10)(c).

(viii) Solution tanks shall be located and protective curbing provided so that chemicals from equipment failure, spillage or accidental drainage shall not enter the water in conduits, treatment or storage basins.

(ix) When polymers are used, storage tanks shall be located away from heat sources and direct sunlight.

**(c) Day Tanks.**

(i) Day tanks shall be provided where dilution of liquid chemical is required prior to feeding.

(ii) Day tanks shall meet all the requirements of R309-525-11(9)(b).

(iii) Certain chemicals, such as polymers, become unstable after hydration, therefore, day tanks shall hold no more than a thirty hour supply unless manufacturer's recommendations allow for longer periods.

(iv) Day tanks shall be scale-mounted, or have a calibrated gauge painted or mounted on the side if liquid levels cannot be observed in a gauge tube or through translucent sidewalls of the tank. In opaque tanks, a gauge rod extending above a referenced point at the top of the tank, attached to a float may be used. The ratio of the cross-sectional area of the tank to its height must be such that unit readings are meaningful in relation to the total amount of chemical fed during a day.

(v) Hand pumps may be provided for transfer from a carboy or drum. A top rack may be used to permit withdrawal into a bucket from a spigot. Where motor-driven transfer pumps are provided a liquid level limit switch and an overflow from the day tank, which will drain by gravity back into the bulk storage tank, must be provided.

(vi) A means which is consistent with the nature of the chemical solution shall be provided to maintain uniform strength of solution in a day tank. continuous agitation shall be provided to maintain chemical slurries in suspension.

(vii) Tanks shall be properly labeled to designate the chemical contained.

**(d) Feed Lines.**

(i) Feed lines shall be as short as possible in length of run, and be:

(A) of durable, corrosion resistant material,

(B) easily accessible throughout the entire length,

(C) protected against freezing, and

(D) readily cleanable.

(ii) Feed lines shall slope upward from the chemical source to the feeder when conveying gases.

(iii) Lines shall be designed with due consideration of scale forming or solids depositing properties of the water, chemical, solution or mixture conveyed.

## (9) Make up Water Supply and Protection.

**(a) In Plant Water Supply.**

In plant water supply shall be:

(i) Ample in supply, adequate in pressure, and of a quality equal to or better than the water at the point of application.

(ii) Provided with means for measurement when preparing specific solution concentrations by dilution.

(iii) Properly protected against backflow.

***Guidance: High calcium content in waters to be treated may interfere with the proposed treatment processes. In these instances, proper treatment for hardness should be provided.***

**(b) Cross-Connection Control.**

Cross-connection control shall be provided to assure that:

(i) The make-up waterlines discharging to solution tanks shall be properly protected from backflow as required by the Utah Plumbing Code.

(ii) Liquid chemical solutions cannot be siphoned through solution feeders into the process units as required in R309-525-11(9)(c).

(iii) No direct connection exists between any sewer and the drain or overflow from the feeder, solution chamber or tank by providing that all pipes terminate at least six inches or two pipe diameters, whichever is greater, above the overflow rim of a receiving sump, conduit or waste receptacle.

(iv) Pre- and post-chlorination systems must be independent to prevent possible siphoning of partially treated water into the clear well. The water supply to each eductor shall have a separate shut-off valve. No master shut off valve will be allowed.

**(c) Liquid Chemical Feeders, Siphon Control.**

Liquid chemical feeders shall be such that chemical solutions cannot be siphoned into the process units, by:

(i) Assuring positive pressure at the point of discharge,

(ii) Providing vacuum relief,

(iii) Providing a suitable air gap, or

(iv) Other suitable means or combinations as necessary.

## (10) Operator Safety.

Design of the plant shall be in accordance with the Utah Occupational Safety and Health Act (UOSHA). The designer and public water system management are responsible to see that they incorporate applicable UOSHA standards into the facility design and operation. Review of facility plans by the Division shall be limited to the following recommendations:

(a) Floor surfaces should be smooth and impervious, slip-proof and well drained,

(b) At least one pair of rubber gloves, a dust respirator of a type certified by the National Institute of Occupational Safety and Health (NIOSH) for toxic dusts, an apron or other protective clothing and goggles or face mask should be provided for each operator, A deluge shower and/or eye washing device should be installed where strong acids and alkalis are used or stored.

(c) A water holding tank that will allow water to reach room temperature should be installed in the water line feeding the deluge shower and eye washing device. Other methods of water tempering may be available.

(d) Adequate ventilation should be provided.

## (11) Design for Specific Chemicals.

Design of the plant shall be in accordance with the Utah Occupational Safety and Health Act (UOSHA). The designer and public water system management are responsible to see that they incorporate applicable UOSHA standards into the facility design and operation. Review of facility plans by the Division shall be limited to the following recommendations:

***Guidance: Chlorine Gas.***
***Precautions regarding chlorine gas are given in Sections R309-205-10 and R309-205-15.***

**Acids and Caustics.**

(i) Acids and caustics should be kept in closed corrosion-resistant shipping containers or storage units.

(ii) Acids and caustics should not be handled in open vessels, but should be pumped in undiluted form from original containers through suitable hose, to the point of treatment or to a covered day tank.

**Sodium Chlorite for Chlorine Dioxide Generation.**

Proposals for the storage and use of sodium chlorite should be approved by the Executive Secretary prior to the preparation of final plans and specifications. Provisions should be made for proper storage and handling of sodium chlorite to eliminate any danger of explosion.

(i) Sodium Chlorite Storage: (A) Sodium chlorite should be stored by itself in a separate room and preferably should be stored in an outside building detached from the water treatment facility. It should be stored away from organic materials which would react violently with sodium chlorite; (B) The storage structures should be constructed of noncombustible materials; (C) If the storage structure is to be located in a area where a fire may occur, water should be available to keep the sodium chlorite area sufficiently cool to prevent decomposition from heat and resultant potential explosive conditions.

(ii) Sodium Chlorite Handling: (A) Care should be taken to prevent spillage; (B) An emergency plan of operation should be available for the clean up of any spillage; (C) Storage drums should be thoroughly flushed prior to recycling or disposal.

(iii) Sodium Chlorite Feeders: (A) Positive displacement feeders should be provided; (B) Tubing for conveying sodium chlorite or chlorine dioxide solutions should be Type 1 PVC, polyethylene or materials recommended by the manufacturer; (C) Feed lines should be installed in a manner to prevent formation of gas pockets and should terminate at a point of positive pressure; (D) Check valves should be provided to prevent the backflow of chlorine into the sodium chlorite line.

## *R309-525-12. Mixing.*

### (1) Flash Mix.

(a) Equipment - Mechanical, in-line or jet mixing devices shall be used.

(b) Mixing - All devices used in rapid mixing shall be capable of imparting a minimum velocity gradient (G) of at least 750 fps per foot. Mixing time shall be less than thirty seconds.

(c) Location - The flash mix and flocculation basins shall be as close together as possible.

(d) Introduction of chemicals - Primary coagulant chemicals shall be added at the point of maximum turbulence within the flash mix unit. Where in-line mixing devices are used chemical injection should be at the most appropriate upstream point.

## (2) Flocculation.

(a) Basin design.

Inlet and outlet design shall prevent short-circuiting and destruction of floc. A drain or pumps shall be provided to handle dewatering and sludge removal.

(b) Detention.

The flow-through velocity shall not be less than 0.5 feet per minute nor greater than 1.5 feet per minute with a detention time for floc formation of at least 30 minutes.

(c) Equipment.

Agitators shall be driven by variable speed drives with the peripheral speed of paddles ranging from 0.5 fps to 2.0 fps. Equipment shall be capable of imparting a velocity gradient (G) between 25 fps per foot and 80 fps per foot to the water treated. Compartmentalized tapered energy flocculation concept may also be used in which G tapers from 100 fps to 10 fps per foot.

(d) Hydraulic flocculation.

Hydraulic flocculation may be permitted and shall be reviewed on a case by case basis. The unit must yield a G value equivalent to that required by b and c above.

(e) Piping.

Flocculation and sedimentation basins shall be as close as possible. The velocity of flocculated water through pipes or conduits to settling basins shall not be less

than 0.5 fps nor greater than 1.5 fps. Allowance must be made to minimize turbulence at bends and changes in direction.

(f) Other designs.

Baffling may be used to provide for flocculation in small plants only after consultation with the Division. The design shall be such that the velocities and flows noted above will be maintained.

(g) Visible floc.

The flocculation unit shall be capable of producing a visible, settleable floc.

***Guidance: If there is significant potential for intercepting wind-blown sediment or debris in the floc basin, a superstructure should be considered.***

## *R309-525-13. Sedimentation.*

### (1) General Design Requirements.

Sedimentation shall follow flocculation. The detention time for effective clarification is dependent upon a number of factors related to basin design and the nature of the raw water. The following criteria apply to conventional sedimentation units:

**(a) Inlet devices.**

Inlets shall be designed to distribute the water equally and at uniform velocities. Open ports, submerged ports, or similar entrance arrangements are required. A baffle shall be constructed across the basin close to the inlet end and shall project several feet below the water surface to dissipate inlet velocities and provide uniform flows across the basin.

**(b) Outlet devices.**

Outlet devices shall be designed to maintain velocities suitable for settling in the basin and to minimize short-circuiting. The use of submerged orifices is recommended in order to provide a volume above the orifices for storage when there are fluctuations in the flow.

**(c) Emergency Overflow.**

An overflow weir (or pipe) shall be installed which will establish the maximum water level desired on top of the filters. It shall discharge by gravity with a free fall to a location where the discharge will be visible.

**(d) Sludge Removal.**

Sludge removal design shall provide that:

(i) sludge pipes shall be not less than three inches in diameter and arranged to facilitate cleaning,

(ii) entrance to sludge withdrawal piping shall prevent clogging,

(iii) valves shall be located outside the basin for accessibility, and

(iv) the operator may observe and sample sludge being withdrawn from the unit.

(v) Sludge collection shall be accomplished by mechanical means.

**(e) Drainage.**

Basins shall be provided with a means for dewatering. Basin bottoms shall slope toward the drain not less than one foot in 12 feet where mechanical sludge collection equipment is not provided.

**(f) Flushing lines.**

Flushing lines or hydrants shall be provided and shall be equipped with backflow prevention devices acceptable to the Executive Secretary.

**(g) Safety.**

Appropriate safety devices shall be included as required by the Occupational Safety and Health Act (OSHA).

***Guidance: Permanent ladders or handholds should be provided on the inside walls of basins above the water level***

**(h) Removal of floating material.**

Provision shall be made for the periodic removal of floating material.

***Guidance: If there is significant potential for intercepting wind-blown sediment or debris in the sedimentation basin, a superstructure should be considered***

## (2) Sedimentation Without Tube Settlers.

If tube settling equipment is not used within settling basins, the following requirements apply:

**(a) Detention Time.**

A minimum of four hours of detention time shall be provided. Reduced sedimentation time may be approved when equivalent effective settling is demonstrated or multimedia filtration is employed.

**(b) Weir Loading.**

The rate of flow over the outlet weir shall not exceed 20,000 gallons per day per foot of weir length. Where submerged orifices are used as an alternate for overflow weirs they shall not be lower than three feet below the water surface when the flow rates are equivalent to weir loading.

**(c) Velocity.**

The velocity through settling basins shall not exceed 0.5 feet per minute. The basins shall be designed to minimize short-circuiting. Fixed or adjustable baffles shall be provided as necessary to achieve the maximum potential for clarification.

**(d) Depth.**

The depth of the sedimentation basin shall be designed for optimum removal.

## (3) Sedimentation With Tube Settlers

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Proposals for settler unit clarification shall be approved by the Executive Secretary prior to the preparation of final plans and specifications.

***Guidance: Settler units consisting of variously shaped tubes or plates which are installed in multiple layers and at an angle to the flow may be used for sedimentation following flocculation***.

(a) Inlet and outlet design shall be such to maintain velocities suitable for settling in the basin and to minimize short circuiting.

(b) Flushing lines shall be provided to facilitate maintenance and be properly protected against backflow or back siphonage. Drain and sludge piping from the settler units shall be sized to facilitate a quick flush of the settler units and to prevent flooding other portions of the plant.

(c) Although most units will be located within a plant, design of outdoor installations shall provide sufficient freeboard above the top of settlers to prevent freezing in the units.

***Guidance: A cover or enclosure is strongly recommended***

(d) The design application rate shall be a maximum rate of 2 gal/sq.ft./min of cross-sectional area (based on 24-inch long 60 degree tubes or 39.5-inch long 7.5 degree tubes), unless higher rates are successfully shown through pilot plant or in-plant demonstration studies.

## *R309-525-14. Solids Contact Units.*

### (1) General.

Solids contact units are generally acceptable for combined softening and clarification where water characteristics, especially temperature, do not fluctuate rapidly, flow rates are uniform and operation is continuous. Before such units are considered as clarifiers without softening, specific approval of the Executive Secretary shall be obtained. A minimum of two units are required for surface water treatment.

***Guidance: Clarifiers should be designed for the maximum uniform rate and should be adjustable to changes in flow which are less than the design rate and for changes in water characteristics.***

### (2) Installation of Equipment

The design engineer shall see that a representative of the manufacturer is present at the time of initial start-up operation to assure that the units are operating properly.

### (3) Operation of Equipment.

The following shall be provided for plant operation:

(a) a complete outfit of tools and accessories,

(b) necessary laboratory equipment, and

(c) adequate piping with suitable sampling taps so located as to permit the collection of samples of water from critical portions of the units.

### (4) Chemical feed.

Chemicals shall be applied at such points and by such means as to insure satisfactory mixing of the chemicals with the water.

### (5) Mixing.

A flash mix device or chamber ahead of solids contact units may be required to assure proper mixing of the chemicals applied. Mixing devices employed shall be so constructed as to:

(a) provide good mixing of the raw water with previously formed sludge particles, and

(b) prevent deposition of solids in the mixing zone.

### (6) Flocculation.

Flocculation equipment:

(a) shall be adjustable (speed and/or pitch),

(b) shall provide for coagulation in a separate chamber or baffled zone within the unit, and

(c) shall provide the flocculation and mixing period to be not less than 30 minutes.

### (7) Sludge concentrators.

(a) The equipment shall provide either internal or external concentrators in order to obtain a concentrated sludge with a minimum of waste water.

(b) Large basins shall have at least two sumps for collecting sludge with one sump located in the central flocculation zone.

### (8) Sludge removal.

Sludge removal design shall provide that:

(a) sludge pipes shall be not less than three inches in diameter and so arranged as to facilitate cleaning,

(b) the entrance to the sludge withdrawal piping shall prevent clogging,

(c) valves shall be located outside the tank for accessibility, and

(d) the operator may observe and sample sludge being withdrawn from the unit.

### (9) Cross-connections.

(a) Blow-off outlets and drains shall terminate and discharge at places satisfactory to the Executive Secretary.

(b) Cross-connection control must be included for the finished drinking water lines used to back flush the sludge lines.

### (10) Detention period.

The detention time shall be established on the basis of the raw water characteristics and other local conditions that affect the operation of the unit. Based on design flow rates, the detention time shall be:

(a) two to four hours for suspended solids contact clarifiers and softeners treating surface water, and

(b) one to two hours for suspended solids contact softeners treating only ground water.

### (11) Suspended slurry concentrate.

Softening units shall be designed so that continuous slurry concentrates of one percent or more, by weight, can be satisfactorily maintained.

### (12) Water losses.

(a) Units shall be provided with suitable controls for sludge withdrawal.

(b) Total water losses shall not exceed:

(i) five percent for clarifiers,

(ii) three percent for softening units.

(c) Solids concentration of sludge bled to waste shall be:

(i) three percent by weight for clarifiers,

(ii) five percent by weight for softeners.

### (13) Weirs or orifices.

The units shall be equipped with either overflow weirs or orifices constructed so that water at the surface of the unit does not travel over 10 feet horizontally to the collection trough.

(a) Weirs shall be adjustable, and at least equivalent in length to the perimeter of the basin.

(b) Weir loading shall not exceed:

(i) 10 gpm per foot of weir length for units used for clarifiers

(ii) 20 gpm per foot of weir length for units used for softeners.

(c) Where orifices are used the loading rates per foot of launderer shall be equivalent to weir loadings. Either shall produce uniform rising rates over the entire area of the tank.

### (14) Upflow rates.

Upflow rates shall not exceed:

(a) 1.0 gpm/sf at the sludge separation line for units used for clarifiers,

(b) 1.75 gpm/sf at the slurry separation line for units used as softeners.

## *R309-525-15. Filtration.*

## (1) General.

Filters may be composed of one or more media layers. Mono-media filters are relatively uniform throughout their depth. Dual or multi-layer beds of filter material are so designed that water being filtered first encounters coarse material, and progressively finer material as it travels through the bed.

## (2) Rate of Filtration.

(a) The rate of filtration shall be determined through consideration of such factors as raw water quality, degree of pretreatment provided, filter media, water quality control parameters, competency of operating personnel, and other factors as determined by the Executive Secretary. Generally, higher filter rates can be assigned for the dual or multi-media filter than for a single media filter because the former is more resistant to filter breakthrough.

(b) The filter rate shall be proposed and justified by the designing engineer to the satisfaction of the Executive Secretary prior to the preparation of final plans and specifications.

(c) The use of dual or multi-media filters may allow a reduction of sedimentation detention time (see R309-525-13(2)(a)) due to their increased ability to store sludge.

(d) Filter rates assigned by the Executive Secretary must never be exceeded, even during backwash periods.

(e) The use of filter types other than conventional rapid sand gravity filters must receive written approval from the Executive Secretary prior to the preparation of final plans and specifications.

## (3) Number of Filters Required.

At least two filter units shall be provided. Where only two filter units are provided, each shall be capable of meeting the plant design capacity (normally the projected peak day demand) at the approved filtration rate. Where more than two filter units are provided, filters shall be capable of meeting the plant design capacity at the approved filtration rate with one filter removed from service. Refer to R309-525-5 for situations where these requirements may be relaxed.

## (4) Media Design.

R309-525-15(4)(a) through R309-525-15(4)(e), which follow, give requirements for filter media design. These requirements are considered minimum and may be made more stringent if deemed appropriate by the Executive Secretary.

**(a) Mono-media, Rapid Rate Gravity Filters.**

The allowable maximum filtration rate for a silica sand, mono-media filter is three gpm/sf This type of filter is composed of clean silica sand having an effective size of 0.35 mm to 0.65 mm and having a uniformity coefficient less than 1.7. The total bed thickness must not be less than 24 inches nor generally more than 30 inches.

**(b) Dual Media, Rapid Rate Gravity Filters.**

The following applies to all dual media filters:

(i) Total depth of filter bed shall not be less than 24 inches nor generally more than 30 inches.

(ii) All materials used to make up the filter bed shall be of such particle size and density that they will be effectively washed at backwash rates between 15 and 20 gpm/sf They must settle to reconstitute the bed essentially in the original layers upon completion of backwashing.

(iii) The bottom layer must be at least ten inches thick and consist of a material having an effective size no greater than 0.45 mm and a uniformity coefficient not greater than 1.5.

(iv) The top layer shall consist of clean crushed anthracite coal having an effective size of 0.45 mm to 1.2 mm, and a uniformity coefficient not greater than 1.5.

(v) Dual media filters will be assigned a filter rate up to six gpm/sf. Generally if the bottom fine layer consists of a material having an effective size of 0.35 mm or less, a filtration rate of six gpm/sf can be assigned.

(vi) Each dual media filter must be provided with equipment which shall continuously monitor turbidity in the filtered water. The equipment shall be so designed to initiate automatic backwash if the filter effluent turbidity exceeds 0.3 NTU. If the filter turbidity exceeds one NTU, filter shutdown is required. In plants attended part-time, this shutdown must be accomplished automatically and shall be accompanied by an alarm. In plants having full-time operators, a one NTU condition need only activate an alarm. Filter shutdown may then be accomplished by the operator.

***Guidance: Due to increased media storage capacity the use of dual media filters may allow a reduction of detention time within sedimentation basins. Refer to R309-525-13(2)(a). Allowable reduction of sedimentation time will be determined by the Executive Secretary.***

**(c) Tri-Media, Rapid Rate Gravity Filters.**

The following applies to all Tri-media filters:

(i) Total depth of filter bed shall not be less than 24 inches nor generally more than 30 inches.

(ii) All materials used to make up the filter bed shall be of such particle size and density that they will be effectively washed at backwash rates between 15 and 20 gpm/sf. They must settle to reconstitute the bed to the normal gradation of coarse to fine in the direction of flow upon completion of backwashing.

(iii) The bottom layer must be at least four inches thick and consist of a material having an effective size no greater than 0.45 mm and uniformity coefficient not greater than 2.2. The bottom layer thickness may be reduced to three inches if it consists of a material having an effective size no greater than 0.25 mm and a uniformity coefficient not greater than 2.2.

(iv) The middle layer must consist of silica sand having an effective size of 0.35 mm to 0.8 mm, and a uniformity coefficient not greater than 1.8.

(v) The top layer shall consist of clean crushed anthracite coal having an effective size of 0.45 mm to 1.2 mm, and a uniformity coefficient not greater than 1.85.

(vi) Tri-media filters will be assigned a filter rate up to 6 gpm/sf. Generally, if the bottom fine layer consists of a material having an effective size of 0.35 mm or less, a filtration rate of six gpm/sf can be assigned.

**(vii) Each Tri-media filter must be provided with equipment which shall continuously monitor turbidity in the filtered water. The equipment shall be so designed to initiate automatic backwash if the effluent turbidity exceeds 0.3 NTU. If the filter turbidity exceeds one NTU, filter shutdown is required. In plants attended part-time, this shutdown must be accomplished automatically and shall be accompanied by an alarm. In plants having full-time operators, a one NTU condition need only activate an alarm. Filter shutdown may then be accomplished by the operator.**

***Guidance: Due to increased media storage capacity, the use of Tri-media filters may allow a reduction of detention time within sedimentation basins. Refer to R309-525-13(2)(a). Allowable reduction of sedimentation time will be determined by the Executive Secretary.***

**(d) Granulated Activated Carbon (GAC).**

Use of granular activated carbon media shall receive the prior approval of the Executive Secretary, and must meet the basic specifications for filter material as given above, and:

(i) There shall be provision for adding a disinfectant to achieve a suitable residual in the water following the filters and prior to distribution,

(ii) There shall be a means for periodic treatment of filter material for control of biological or other growths,

(iii) Facilities for carbon regeneration or replacement must be provided.

**(e) Other Media Compositions and Configurations.**

Filters consisting of materials or configurations not prescribed in this section will be considered on experimental data or available operation experience.

## (5) Support Media, Filter Bottoms and Strainer Systems.

Care must be taken to insure that filter media, support media, filter bottoms and strainer systems are compatible and will give satisfactory service at all times.

**(a) Support Media.**

The design of support media will vary with the configuration of the filtering media and the filter bottom. Thus, support media and/or proprietary filter bottoms shall be reviewed on a case-by-case basis.

***Guidance: Guidelines for two types of support media commonly used are as follows:***

***(1) Torpedo Sand- A three inch layer of torpedo sand should be used as a supporting media for the filter sand in single media filters and should have: (A) Effective size of 0.3 mm to 2.0 mm, and (B) Uniformity coefficient not greater than 1.7.***

***(2) Gravel- Gravel, when used as the supporting media, should consist of hard, rounded particles and should not include flat or elongated particles. The coarsest gravel should be 2.5 inches in size when the gravel rests directly on the strainer system, and should extend above the top of the perforated laterals. Not lass than four layers of gravel should be provided in accordance with the following size and depth distribution when used with perforated laterals:***

| ***Guidance Support Gravel*** | |
|---|---|
| *Size* | *Depth* |
| *2-1/2 to 1-1/2 inches* | *5 to 8 inches* |
| *1-1/2 to 3/4 inches* | *3 to 5 inches* |
| *3/4 to ½ inches* | *3 to 5 inches* |
| *½ to 3/16 inches* | *2 to 3 inches* |
| *3/16 to 3/32 inches* | *2 to 3 inches* |

***(3) When proprietary filter bottoms are specified a reduction of gravel depths may be considered if such a reduction can be justified to the satisfaction of the Executive Secretary.***

**(b) Filter Bottoms and Strainer Systems.**

(i) The design of manifold type collection systems shall:

(A) Minimize loss of head in the manifold and laterals,

(B) Assure even distribution of washwater and even rate of filtration over the entire area of the filter,

(C) Provide a ratio of the area of the final openings of the strainer system to the area of the filter of about 0.003,

(D) Provide the total cross-sectional area of the laterals at about twice the total area of the final openings,

(E) Provide the cross-sectional area of the manifold at 1.5 to 2 times the total area of the laterals.

(ii) Departures from these standards may be acceptable for high rate filter and for proprietary bottoms.

(iii) Porous plate bottoms shall not be used where calcium carbonate, iron or manganese may clog them or with waters softened by lime.

## (6) Structural Details and Hydraulics.

The filter structure shall be so designed as to provide for:

(a) Vertical walls within the filter,

(b) No protrusion of the filter walls into the filter media,

(c) Cover by superstructure,

(d) Head room to permit normal inspection and operation,

(e) Minimum water depth over the surface of the filter media of three feet, unless an exception is granted by the Executive Secretary,

(f) Maximum water depth above the filter media shall not exceed 12 feet,

(g) Trapped effluent to prevent backflow of air to the bottom of the filters,

(h) Prevention of floor drainage to enter onto the filter by installation of a minimum four inch curb around the filters,

(i) Prevention of flooding by providing an overflow or other means of control,

(j) Maximum velocity of treated water in pipe and conduits to filters of two fps,

(k) Cleanouts and straight alignment for influent pipes or conduits where solids loading is heavy or following lime-soda softening,

(l) Washwater drain capacity to carry maximum flow,

(m) Walkways around filters, to be not less than 24 inches wide,

(n) Safety handrails or walls around filter areas adjacent to normal walkways,

(o) No common wall between filtered and unfiltered water shall exist. This requirement may be waived by the Executive Secretary for small "package" type plants using metal tanks of sufficient thickness,

(p) Filtration to waste for each filter.

## (7) Backwash.

### (a) Water Backwash Without Air.

Water backwash systems shall be designed so that backwash water is not recycled to the head of the treatment plant unless it has been settled, as a minimum. Furthermore, water backwash systems; including tanks, pumps and pipelines, shall:

(i) Provide a minimum backwash rate of 15 gpm/sf, consistent with water temperatures and the specific gravity of the filter media. The design shall provide for adequate backwash with minimum media loss. A reduced rate of 10 gpm/sf may be acceptable for full depth anthracite or granular activated carbon filters.

***Guidance: A rate of 20 gpm/sf or a rate necessary to provide for a 50 percent expansion of the filter bed is recommended.***

(ii) provide finished drinking water at the required rate by washwater tanks, a washwater pump, from the high service main, or a combination of these.

(iii) Permit the backwashing of any one filter for not less than 15 minutes.

(iv) Be capable of backwashing at least two filters, consecutively.

(v) Include a means of varying filter backwash rate and time.

(vi) Include a washwater regulator or valve on the main washwater line to obtain the desired rate of filter wash with washwater valves or the individual filters open wide.

(vii) Include a rate of flow indicator, preferably with a totalizer on the main washwater line, located so that it can be easily read by the operator during the washing process.

(viii) Be designed to prevent rapid changes in backwash water flow.

(ix) Use only finished drinking water.

(x) Have washwater pumps in duplicate unless an alternate means of obtaining washwater is available.

(xi) Perform in conjunction with "filter to waste" system to allow filter to stabilize before introduction into clearwell.

**(b) Backwash with Air Scouring.**

Air scouring can be considered in place of surface wash when:

(i) air flow for air scouring the filter must be 3 to 5 scfm/sf of filter area when the air is introduced in the underdrain; a lower air rate must be used when the air scour distribution system is placed above the underdrains,

(ii) a method for avoiding excessive loss of the filter media during backwashing must be provided,

(iii) air scouring must be followed by a fluidization wash sufficient to restratify the media,

(iv) air must be free from contamination,

(v) air scour distribution systems shall be placed below the media and supporting bed interface; if placed at the interface the air scour nozzles shall be designed to prevent media from clogging the nozzles or entering the air distribution system.

(vi) piping for the air distribution system shall not be flexible hose which will collapse when not under air pressure and shall not be a relatively soft material which may erode at the orifice opening with the passage of air at high velocity.

(vii) air delivery piping shall not pass down through the filter media nor shall there be any arrangement in the filter design which would allow short circuiting between the applied unfiltered water and the filtered water,

(viii) consideration shall be given to maintenance and replacement of air delivery piping,

(ix) when air scour is provided the backwash water rate shall be variable and shall not exceed eight gpm/sf unless operating experience shows that a higher rate is necessary to remove scoured particles from filter surfaces.

(x) the filter underdrains shall be designed to accommodate air scour piping when the piping is installed in the underdrain, and

(xi) the provisions of Section R309-525-15(7)(a) (Backwash) shall be followed.

## (8) Surface Wash or Subsurface Wash.

Surface wash or subsurface wash facilities are required except for filters used exclusively for iron or manganese removal. Washing may be accomplished by a system of fixed nozzles or a revolving-type apparatus, provided:

(a) Provisions for water pressures of at least 45 psi,

(b) A properly installed vacuum breaker or other approved device to prevent back-siphonage if connected to a finished drinking water system,

(c) All washwater must be finished drinking water,

(d) Rate of flow of two gpm/sf of filter area with fixed nozzles or 0.5 gpm/sf with revolving arms.

## (9) Washwater Troughs.

Washwater troughs shall be so designed to provide:

(a) The bottom elevation above the maximum level of expanded media during washing,

(b) A two inch freeboard at the maximum rate of wash,

(c) The top edge level and all edges of trough at the same elevation

(d) Spacing so that each trough serves the same number of square feet of filter areas,

(e) Maximum horizontal travel of suspended particles to reach the trough not to exceed three feet.

## (10) Appurtenances.

(a) The following shall be provided for every filter:

(i) Sample taps or means to obtain samples from influent and effluent,

(ii) A gauge indicating loss of head,

(iii) A meter indicating rate-of-flow. A modified rate controller which limits the rate of filtration to a maximum rate may be used. However, equipment that simply maintains a constant water level on the filters is not acceptable, unless the rate of flow onto the filter is properly controlled,

(iv) A continuous turbidity monitoring device where the filter is to be loaded at a rate greater than three gpm/sf

(v) Provisions for draining the filter to waste with appropriate measures for backflow prevention (see R309-525-23)

***Guidance: The following should be provided for every filter:***

***(1) Wall sleeves providing access to the filter interior at several locations for sampling or pressure sensing,***

***(2) A 1.0 inch to 1.5 inch diameter pressure hose and storage rack at the operating floor for washing filter walls.***

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### (11) Miscellaneous.

Roof drains shall not discharge into filters or basins and conduits preceding the filters.

## *R309-525-16. In-Plant Finished Drinking Water Storage.*

### (1) General.

In addition to the following, the applicable design standards of R309-545 shall be followed for plant storage.

(a) Backwash Water Tanks.

Backwash water tanks shall be sized, in conjunction with available pump units and finished water storage, to provide the backwash water required by R309-525-15(7). Consideration shall be given to the backwashing of several filters in rapid succession.

(b) Clearwell.

Clearwell storage shall be sized, in conjunction with distribution system storage, to relieve the filters from having to follow fluctuations in water use.

(i) When finished water storage is used to provide the contact time for chlorine (see R309-520-10(1)(f), especially sub-section (f)(iv)), special attention must be given to size and baffling.

(ii) To ensure adequate chlorine contact time, sizing of the clearwell shall include extra volume to accommodate depletion of storage during the nighttime for intermittently operated filtration plants with automatic high service pumping from the clearwell during non-treatment hours.

(iii) An overflow and vent shall be provided.

### (2) Adjacent Compartments.

Finsihed drinking water shall not be stored or conveyed in a compartment adjacent to unsafe water when the two compartments are separated by a single wall. The Executive Secretary may grant an exception to this requirement for small "package" treatment plants using metal tanks of sufficient wall thickness.

### (3) Basins and Wet-Wells.

Receiving basins and pump wet-wells for finished drinking water shall be designed as drinking water storage structures. (See Section R309-545)

## *R309-525-17. Miscellaneous Plant Facilities.*

### (1) Laboratory.

Sufficient laboratory equipment shall be provided to assure proper operation and monitoring of the water plant. A list of required laboratory equipment is:

(a) one floc testing apparatus with illuminated base and variable speed stirrer,

(b) 10 each 1000 ml Griffin beakers (plastic is highly recommended over glass to prevent breakage),

(c) one 1000 ml graduated cylinder (plastic is highly recommended over glass to prevent breakage),

(d) pH test strips (6.0 to 8.5),

(e) five wide mouth 25 ml Mohr pipets,

(f) one triple beam, single pan or double pan balance with 0.1 g sensitivity and 2000 g capacity (using attachment weights),

(g) DPD chlorine test kit,

(h) bench-top turbidimeter,

(i) five each 1000 ml reagent bottles with caps,

(j) dish soap,

(k) brush (2 3/4 inch diameter by 5 inch),

(l) one platform scale 1/2 lb sensitivity, 100 lb capacity,

(m) book - Simplified Procedures for Water Examination, AWWA Manual M12

### (2) Continuous Turbidity Monitoring and Recording Equipment.

Continuous turbidity monitoring and recording facilities shall be located as specified in R309-215-9.

### (3) Sanitary and Other Conveniences.

All treatment plants shall be provided with finished drinking water, lavatory and toilet facilities unless such facilities are otherwise conveniently available. Plumbing must conform to the Utah Plumbing Code and must be so installed to prevent contamination of a public water supply.

## *R309-525-18. Sample Taps.*

Sample taps shall be provided so that water samples can be obtained from appropriate locations in each unit operation of treatment. Taps shall be consistent with sampling needs and shall not be of the petcock type. Taps used for obtaining samples for bacteriological analysis shall be of

the smooth-nosed type without interior or exterior threads, shall not be of the mixing type, and shall not have a screen, aerator, or other such appurtenance.

## *R309-525-19. Operation and Maintenance Manuals.*

Operation and maintenance manuals shall be prepared for the treatment plant and found to be acceptable by the Executive Secretary. The manuals shall be usable and easily understood. They shall describe normal operating procedures, maintenance procedures and emergency procedures.

## *R309-525-20. Operator Instruction.*

Provisions shall be made for operator instruction at the start-up of a plant.

## *R309-525-21. Safety.*

All facilities shall be designed and constructed with due regard for safety, comfort and convenience. As a minimum, all applicable requirements of Utah Occupational Safety and Health Act (UOSHA) must be adhered to.

## *R309-525-22. Disinfection Prior To Use.*

All pipes, tanks, and equipment which can convey or store finished drinking water shall be disinfected in accordance with the following AWWA procedures:

(1) C651-99 Disinfecting Water Mains

(2) C652-92 Disinfection of Water Storage Facilities

(3) C653-97 Disinfection of Water Treatment Plants

## *R309-525-23. Disposal of Treatment Plant Waste.*

Provisions must be made for proper disposal of water treatment plant waste such as sanitary, laboratory, sludge, and filter backwash water. All waste discharges and treatment facilities shall meet the requirements of the plumbing code, the Utah Department of Environmental Quality, the Utah Department of Health, and the United States Environmental Protection Agency, including the following:

(1) Rules for Onsite Wastewater Disposal Systems, Utah Administrative Code R317-4.

(2) Rules for Water Quality, Utah Administrative Code R317.

(3) Rules for Solid and Hazardous Waste, Utah Administrative Code R315.

In locating waste disposal facilities, due consideration shall be given to preventing potential contamination of a water supply as well as breach or damage due to environmental factors.

## *R309-525-24. Other Considerations.*

Consideration shall be given to the design requirements of other federal, state, and local regulatory agencies for items such as safety requirements, special designs for the handicapped, plumbing and electrical codes, construction in the flood plain, etc.

## *R309-525-25. Operation and Maintenance.*

(1) Water system operators must determine that all chemicals added to water intended for human consumption are suitable for drinking water use and comply with ANSI/NSF Standard 60.

(2) No chemicals or other substances may be added to public water supplies unless the chemical addition facilities and chemical type have been reviewed and approved by the Executive Secretary. The Executive Secretary shall be notified prior to the changing of primary coagulant type. The Executive Secretary may require documentation to verify that sufficient testing and analysis have been done. The primary coagulant may not be changed without prior approval from the Executive Secretary.

(3) During the operation of a conventional surface water treatment plant stable flow rates shall be maintained through the filters.

***Guidance: Water should not be introduced into the system immediately after backwashing. Rather, water should be filtered to waste. A "dirty filter" should not be started and immediately introduced into the system. If the filter has sat idle for an extended period, or if the filter is sufficiently "dirty", backwash and filter to waste before introducing the water.***

**(4) All instrumentation needed to verify that treatment processes are sufficient shall be properly calibrated and maintained. As a minimum, this shall include turbidimeters.**

**KEY: drinking water, flocculation, sedimentation, filtration**
**December 16, 2002 19-4-104**

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# R309-530 Alternative Surface Water Treatment Methods (Effective December 9, 2001)

## Table of Contents

# R309-530. Facility Design and Operation: Alternative Surface Water Treatment Methods.

## *R309-530-1. Purpose.*

This rule specifies requirements for alternative surface water treatment methods. It is intended to be applied in conjunction with rules R309-500 through R309-550. Collectively, these rules govern the design, construction, operation and maintenance of public drinking water system facilities. These rules are intended to assure that such facilities are reliably capable of supplying adequate quantities of water which consistently meet applicable drinking water quality requirements and do not pose a threat to general public health.

## *R309-530-2. Authority.*

This rule is promulgated by the Drinking Water Board as authorized by Title 19, Environmental Quality Code, Chapter 4, Safe Drinking Water Act, Subsection 104(1)(a)(ii) of the Utah Code and in accordance with subsection 63-46a of the same, known as the Administrative Rulemaking Act.

## *R309-530-3. Definitions.*

Definitions for certain terms used in this rule are given in R309-110 but may be further clarified herein.

## *R309-530-4. General.*

### (1) Alternative Methods.

In addition to conventional surface water treatment method (i.e. coagulation, sedimentation and filtration as outlined in R309-525), several alternative methods may also be suitable. They are: Direct Filtration; Slow Sand Filtration; Membrane Filtration; and Diatomaceous Earth Filtration.

### (2) Incorporation of Other Rules.

For each process described in this section pertinent rules are given. The designer shall also incorporate the relevant rules given in other sections into the plans and specifications for any of these specialized treatment methods. Where applicable, the following topics shall be addressed:

(a) Plant Siting (see R309-525-6).

(b) Pre-design Submittal (see R309-515-5(2)).

(c) Plant Reliability (see R309-525-7).

(d) Color Coding and Pipe Marking (see R309-525-8).

(e) Chemical Addition (see R309-525-11).

(f) Miscellaneous Plant Facilities (see R309-525-17, particularly sub-section R309-525-17(1), Laboratory).

(g) Operation and Maintenance Manuals (see R309-525-19).

(h) Safety (see R309-525-21).

(i) Disposal of Treatment Plant Waste (see R309-525-23).

(j) Disinfection (see R309-520).

## *R309-530-5. Direct Filtration.*

### (1) Chemical Addition and Mixing.

Direct Filtration is conventional surface water treatment without the sedimentation process. Rules for Chemical Addition and Mixing shall be the same as found in sections R309-525-11 and R309-525-12.

### (2) Source Water Quality.

Direct Filtration applies the destabilized colloids to the filter rather than removing the majority of the load through sedimentation. While this process represents considerable construction cost savings, the source water must have low average turbidity in order to provide reliable service without excessive backwash requirements. Source water with low average turbidity is generally only obtained from large capacity reservoirs.

### (3) Design Requirements.

The following requirements shall apply to Direct Filtration plants:

(a) At least one year's record of source water turbidity, sampled at least once per week, shall be presented to the Executive Secretary. A Direct Filtration facility will only be permitted if the data shows that 75% of the measurements are below five (5) NTU. The Executive Secretary shall judge whether Direct Filtration is suitable given the quality of the proposed source water (see R309-515-5(2)(a)(ii)).

(b) Pilot plant studies, acceptable to the Executive Secretary, shall be conducted prior to the preparation of final engineering plans.

(c) Requirements for flash mix and flocculation basin design are given in sub-sections R309-525-12(1) and R309-525-12(2).

(d) Chemical addition and mixing equipment shall be designed to be capable of providing a visible, but not necessarily settleable, floc.

(e) Surface wash, subsurface wash, or air scour shall be provided for the filters in accordance with sub-section R309-525-15(7).

(f) A continuous monitoring turbidimeter shall be installed on each filter effluent line and shall be of a type with at least two alarm conditions capable of meeting the requirements of subsections R309-525-15(4)(b)(vi) or R309-525-15(4)(c)(vii). The combined plant effluent shall be equipped with a continuous turbidimeter having a chart recorder. Additional monitoring equipment to assist in control of the coagulant dose may be required (i.e. streaming current gauges, particle counters, etc.) if the plant cannot consistently meet the requirements of rule R309-103.

(g) In addition to the alarm conditions required above, the plant shall be designed and operated so that the plant will automatically shut down when a source water turbidity of 20 NTU lasts longer than three hours, or when the source water turbidity exceeds 30 NTU at any time.

(h) The plant design and land ownership surrounding the plant shall allow for the installation of conventional sedimentation basins. Sedimentation basins may be required if the Executive Secretary determines the plant is failing to meet minimum water quality or performance standards.

## *R309-530-6. Slow Sand Filtration.*

### (1) Acceptability.

Slow sand filtration means a process involving passage of raw water through a bed of sand at low velocity resulting in substantial particle removal by physical and biological mechanisms. The acceptability of slow sand filters as a substitute for "conventional surface water treatment" facilities (detailed in R309-525) shall be determined by the

Executive Secretary based on suitability of the source water and demand characteristics of the system.

## (2) Source Water Quality.

The Executive Secretary may impose design requirements in addition to those listed herein, in allowing this process. The following shall be considered, among other factors, in determining whether slow sand filtration will be acceptable:

(a) Source water turbidity must be low and consistent. Slow Sand Filtration shall be utilized only when the source waters have turbidity less than 50 NTU and color less than 30 units (see R309-515-5(2)(a)).

(b) The nature of the turbidity particles shall be considered. Turbidity must not be attributable to colloidal clay.

(c) The nature and extent of algae growths in the raw water shall be considered. Algae must not be a species considered as filter and screen-clogging algae as indicated in "Standard Methods for the Examination of Water and Wastewater" prepared and published jointly by American Public Health Association, American Water Works Association, and Water Environment Federation. High concentrations of algae in the raw water can cause short filter runs; the amount of algae, expressed as the concentration of chlorophyll a in the raw water shall not exceed 0.005 mg/l.

## (3) Pilot Plant Studies.

The Executive Secretary shall allow the use of Slow Sand Filtration only when the supplier's engineering studies show that the slow sand facility can consistently produce an effluent meeting the quality requirements of rule R309-103. The Executive Secretary should be consulted prior to the detailed design of a slow sand facility.

## (4) Operation.

Effluent from a Slow Sand Filtration facility shall not be introduced into a public water supply until an active biological mat has been created on the filter.

## (5) Design requirements.

The following design parameters shall apply to each Slow Sand Filtration plant:

(a) At least three filter units shall be provided. Where only three units are provided, any two shall be capable of meeting the plant's design capacity (normally the projected "peak daily flow") at the approved filtration rate. Where more than three filter units are provided, the filters shall be capable of meeting the plant design capacity at the approved filtration rate with any one filter removed from service.

(b) All filters shall be protected to prevent freezing. If covered by a structure, enough headroom shall exist to permit normal movement by operating personnel for scraping and sand removal operations. There shall be adequate manholes and access ports for the handling of sand. An overflow at the maximum filter water level shall be provided.

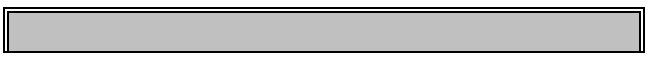
(c) The permissible rates of filtration shall be determined by the quality of the source water and shall be determined by experimental data derived during pilot studies conducted on the source water. Filtration rates of 0.03 gpm/sf to 0.01 gpm/sf shall be acceptable (equivalent to two to six million gallons per day per acre). Somewhat higher rates may be acceptable when demonstrated to the satisfaction of the Executive Secretary.

(d) Each filter unit shall be equipped with a main drain and an adequate number of lateral underdrains to collect the filtered water. The underdrains shall be so spaced that the maximum velocity of the water flow in the underdrain will not exceed 0.75 fps. The maximum spacing of the laterals shall not exceed three feet if pipe laterals are used.

(e) Filter sand shall be placed on graded gravel layers for an initial filter sand depth of 30 inches. A minimum of 24 inches of filter sand shall be present, even after scraping. The effective size of the filter sand shall be between 0.30 mm and 0.45 mm in diameter. The filter sand uniformity coefficient shall not exceed 2.5. Further, the sand shall throughly washed and found to be clean and free from foreign matter.

(f) A three-inch layer of well rounded sand shall be used as a supporting media for filter sand. It shall have an effective size of 0.8 mm to 2.0 mm in diameter and the uniformity coefficient shall not be greater than 1.7.

(g) A supporting gravel media shall be provided. It shall consist of hard, durable, rounded silica particles and shall not include flat or elongated particles. The coarsest gravel shall be 2.5 inches in size when the gravel rests directly on the strainer system, and must extend above the top of the perforated laterals. Not less than four layers of gravel shall be provided in accordance with the following size and depth distribution when used with perforated laterals:



| Table 530-1 | |
|---|---|
| Size | Depth |
| 2 ½ to 1 ½ inches | 5 to 8 inches |
| 1 ½ to 3/4 inches | 3 to 5 inches |
| 3/4 to ½ inches | 3 to 5 inches |
| ½ to 3/16 inches | 2 to 3 inches |
| 3/16 to 3/32 inches | 2 to 3 inches |

Reduction of gravel depths may be considered upon justification to the Executive Secretary when proprietary filter bottoms are specified.

(h) Slow sand filters shall be designed to provide a depth of at least three to five feet of water over the sand.

(i) Each filter shall be equipped with: a loss of head gauge; an orifice, venturi meter, or other suitable metering device installed on each filter to control the rate of filtration; and an effluent pipe designed to maintain the water level above the top of the filter sand.

(j) Disinfection of the effluent of Slow Sand Filtration plants will be required.

(k) A filter-to-waste provision shall be included.

(l) Electrical power shall be available at the plant site.

## *R309-530-7. Diatomaceous Earth Filtration.*

The use of Diatomaceous Earth Filtration units may be considered for application to surface waters with low turbidity and low bacterial contamination, and additionally may be used for iron removal for groundwaters of low quality, providing the removal is effective and the water is of sanitary quality before treatment.

The acceptability of Diatomaceous Earth Filtration as a substitute for "conventional surface water treatment" facilities (detailed in rule R309-525) shall be determined by the Executive

Secretary. Determination may be based on the level of support previously exhibited by the public water system management along with a finding by the Executive Secretary that "conventional surface water treatment" or other methods herein described are too costly or unacceptable.

Diatomaceous Earth Filtration consists of a process to remove particles from water wherein a precoat cake of diatomaceous earth filter media is deposited on a support membrane (septum), and while the water is filtered by passing through the cake on the septum, additional filter media known as body feed is continuously added to the source water to maintain the permeability of the filter cake. Diatomite filters are characterized by rigorous operating requirements, high operating costs, and increased sludge production.

Part 4, Section 4.2.3, Diatomaceous Earth Filtration, in the Recommended Standards for Water Works (commonly known as "Ten State Standards"), 1997 edition is hereby incorporated by reference and shall govern the design and operation of diatomaceous earth filtration facilities. This document is published by the Great Lakes-Upper Mississippi River Board of Public Health and Environmental Managers. A copy is available in the office of the Division for reference.

## *R309-530-8. Membrane Technology.*

### (1) Acceptability.

Surface waters, or groundwater under the direct influence of surface water (UDI), may be treated using membrane technology (microfiltration, ultrafiltration, nanofiltration) coupled with "primary and secondary disinfection."

### (2) Pilot Plant Study.

Because this is a relatively new technology, appropriate investigation shall be conducted by the public water system to assure that the process will produce the required quality of water at a cost which can be borne by the public water system consumers. A pilot plant study shall be conducted prior to the commencement of design. The study must be conducted in accordance with EPA's Environmental Technology Verification Program (ETV) or the protocol and treated water parameters must be approved prior to conducting any testing by the Executive Secretary.

### (3) Design Requirements.

The following items shall be addressed in the design of any membrane technology plant intended to provide microbiological treatment of surface waters or groundwater "UDI:"

(a) The facility shall be equipped with an on-line particle counter on the final effluent.

(b) The facility shall be equipped with an automatic membrane integrity test system.

**(4) The Executive Secretary shall establish the turbidity limit** for 95% of turbidity measurements and the maximum turbidity limit which shall not be exceeded. The plant effluent shall meet the requirements of R309-200-5(5)(a)(ii).

## *R309-530-9. New Treatment Processes or Equipment.*

The policy of the Board is to encourage, rather than to obstruct, the development of new methods and equipment for the treatment of water. Nevertheless, any new processes or equipment must have been thoroughly tested in full-scale, comparable installations, before approval of plans can be issued. Refer to EPA's Environmental Technology Verification Program (ETV).

No new treatment process will be approved for use in Utah unless the designer or supplier can present evidence satisfactory to the Executive Secretary that the process will insure the delivery of water of safe, sanitary quality, without imposing undue problems of supervision, operation and/or control.

The Executive Secretary shall establish the turbidity limit for 95% of turbidity measurements and the maximum turbidity limit which shall not be exceeded. The plant effluent shall meet the requirements of R309-200-5(5)(a)(ii).

***Guidance: Any municipality, water district, or institution purchasing novel equipment should be amply protected by a performance bond or other acceptable arrangement, so that any expenditure of money will be refunded in case of failure of any process or equipment. The performance bond should include provisions to cover the cost of any alterations deemed necessary by the Executive Secretary.***

**KEY: drinking water, direct filtration, slow sand filtration, membrane technology**
**December 9, 2002** **19-4-104**

# R309-535 Miscellaneous Treatment Methods (Effective May 1, 2001)

## Table of Contents

# R309-535. Facility Design and Operation: Miscellaneous Treatment Methods.

## *R309-535-1. Purpose.*

The purpose of this rule is to provide specific requirements for miscellaneous water treatment methods which are primarily intended to remove chemical contaminants from drinking water; or, adjust the chemical composition of drinking water. It is intended to be applied in conjunction with other rules, specifically R309-500 through R309-550. Collectively, these rules govern the design, construction, operation and maintenance of public drinking water system facilities. These rules are intended to assure that such facilities are reliably capable of supplying adequate quantities of water which consistently meet applicable drinking water quality requirements and do not pose a threat to general public health.

## *R309-535-2. Authority.*

This rule is promulgated by the Drinking Water Board as authorized by Title 19, Environmental Quality Code, Chapter 4, Safe Drinking Water Act, Subsection 104(1)(a)(ii) of the Utah Code and in accordance with 63-46a of the same, known as the Administrative Rulemaking Act.

## *R309-535-3. Definitions.*

Definitions for certain terms used in this rule are given in R309-110 but may be further clarified herein.

## *R309-535-4. General.*

For each process described in this section pertinent rules are given. The designer must also, however, incorporate the relevant rules given in other sections into the plans and specifications for any of these specialized treatment methods. Where applicable, the following topics must be addressed:

(1) Plant Siting (see R309-525-6).

(2) Plant Reliability (see R309-525-7).

(3) Color Coding and Pipe Marking (see R309-525-8).

(4) Chemical Addition (see R309-525-11).

(5) Miscellaneous Plant Facilities (see R309-525-17, particularly sub-section R309-525-17(1), Laboratory).

(6) Operation and Maintenance Manuals (see R309-525-19).

(7) Safety (see R309-525-21).

(8) Disposal of Treatment Plant Waste (see R309-525-23).

(9) Disinfection (see R309-520).

## *R309-535-5. Fluoridation.*

Sodium fluoride, sodium silicofluoride and fluorosilicic acid shall conform to the applicable AWWA standards and/or ANSI/NSF Standard 60. Other fluoride compounds which may be available must be approved by the Executive Secretary.

### (1) Fluoride compound storage.

Fluoride chemicals should be isolated from other chemicals to prevent contamination. Compounds shall be stored in covered or unopened shipping containers and should be stored inside a building. Unsealed storage units for fluorosilicic acid should be vented to the atmosphere at a point outside any building. Bags, fiber drums and steel drums should be stored on pallets.

### (2) Chemical feed equipment and methods.

In addition to the requirements in R309-525-11 "Chemical Addition", fluoride feed equipment shall meet the following requirements:

(a) scales, loss-of-weight recorders or liquid level indicators, as appropriate, accurate to within five percent of the average daily change in reading shall be provided for chemical feeds,

(b) feeders shall be accurate to within five percent of any desired feed rate,

(c) fluoride compound shall not be added before lime-soda softening or ion exchange softening,

(d) the point of application of fluorosilicic acid, if into a horizontal pipe, shall be in the lower half of the pipe,

(e) a fluoride solution shall be applied by a positive displacement pump having a stroke rate not less than 20 strokes per minute,

(f) a spring opposed diaphragm type anti-siphon device shall be provided for all fluoride feed lines and dilution water lines,

(g) a device to measure the flow of water to be treated is required,

(h) the dilution water pipe shall terminate at least two pipe diameters above the solution tank,

(i) water used for sodium fluoride dissolution shall be softened if hardness exceeds 75 mg/l as calcium carbonate,

(j) fluoride solutions shall be injected at a point of continuous positive pressure or a suitable air gap provided,

(k) the electrical outlet used for the fluoride feed pump should have a nonstandard receptacle and shall be interconnected with the well or service pump,

(l) saturators should be of the upflow type and be provided with a meter and backflow protection on the makeup water line.

## (3) Secondary controls.

Secondary control systems for fluoride chemical feed devices shall be provided as a means of reducing the possibility for overfeed; these may include flow or pressure switches or other devices.

## (4) Protective equipment.

Personal protective equipment as outlined in R309-525-11(10) shall be provided for operators handling fluoride compounds. Deluge showers and eye wash devices shall be provided at all fluorosilicic acid installations.

## (5) Dust control.

(a) Provision must be made for the transfer of dry fluoride compounds from shipping containers to storage bins or hoppers in such a way as to minimize the quantity of fluoride dust which may enter the room in which the equipment is installed. The enclosure shall be provided with an exhaust fan and dust filter which place the hopper under a negative pressure. Air exhausted from fluoride

handling equipment shall discharge through a dust filter to the outside atmosphere of the building.

(b) Provision shall be made for disposing of empty bags, drums or barrels in a manner which will minimize exposure to fluoride dusts. A floor drain should be provided to facilitate the hosing of floors.

### (6) Testing equipment.

Equipment shall be provided for measuring the quantity of fluoride in the water. Such equipment shall be subject to the approval of the Executive Secretary.

## *R309-535-6. Taste and Odor Control.*

Part 4, Section 4.9, Taste and Odor Control, in the Recommended Standards for Water Works (commonly known as "Ten State Standards"), 1997 edition is hereby incorporated by reference and shall govern the design and operation of taste and odor control facilities. This document is published by the Great Lakes-Upper Mississippi River Board of Public Health and Environmental Managers. A copy is available in the office of the Division for reference.

## *R309-535-7. Stabilization.*

Part 4, Section 4.8, Stabilization, in the Recommended Standards for Water Works (commonly known as "Ten State Standards"), 1997 edition is hereby incorporated by reference and it shall govern the design and operation of stabilization facilities. This document is published by the Great Lakes-Upper Mississippi River Board of Public Health and Environmental Managers. A copy is available in the office of the Division for reference.

## *R309-535-8. Deionization.*

Current practical methods of deionization include Ion Exchange, Reverse Osmosis and Electrodialysis. Additional methods of deionization may be approved subject to the presentation of evidence of satisfactory reliability.

All properly developed groundwater sources having water quality exceeding 2,000 mg/l Total Dissolved Solids and/or 500 mg/l Sulfate shall be either properly diluted or treated by the methods outlined in this section. Deionization cannot be considered a substitute process for conventional complete treatment outlined in R309-525.

## (1) Ion Exchange.

### (a) General.

Great care shall be taken by the designer to avoid loading the media with water high in organics.

***Guidance: Deionization using ion exchange has generally been high in chemical costs but low in maintenance and capital costs. Pretreatment may be necessary depending on the source of supply. Organic contamination may irreversibly foul the ion exchange resin if adequate precautions are not observed. This design is generally less sensitive to the presence of iron and manganese. Since ion exchange can produce water very low in Total Dissolved Solids, blending is sometimes appropriate.***

### (b) Design.

(i) Pretreatment shall be provided per the manufacturer's recommendation.

(ii) Upflow or down flow units are acceptable.

(iii) Exchangers shall have at least a three foot media depth.

(iv) Exchangers shall be designed to meet the recommendations of the media manufacturer with regard to flow rate or contact time. In any case, flow shall not exceed seven gpm/sf of bed area. The plant shall be provided with an influent or effluent meter as well as a meter on any bypass line.

(v) Chemical feeders used shall conform with R309-525-8. All solution tanks shall be covered.

(vi) Regenerants added shall be uniformly distributed over the entire media surface of upflow or downflow units. Regeneration shall be according to the media manufacturer's recommendations.

***Guidance: Safety precautions should be observed around concentrated acids and bases.***

(vii) The wash rate capability shall be in excess of the manufacturers recommendation and should be at least six to eight gpm/sf of bed area.

***Guidance: Care should be taken in the design to prevent the loss of media during washing.***

(viii) Disinfection (see R309-520) shall be required ahead of the exchange units where this does not interfere with the media.

***Guidance: This often improves filtration by minimizing bacterial growth or slimes***.

Where disinfection interferes with the media, disinfection shall follow the treatment process.

**(c) Waste Disposal.**

Waste generated by ion exchange treatment shall be disposed of in accordance with R309-525-23.

## (2) Reverse Osmosis.

**(a) General.**

The design shall permit the easy exchange of modules for cleaning or replacement.

***Guidance: Reverse Osmosis (R.O.) has generally been low in chemical and maintenance cost but high in energy and capital costs. In general, experience indicates that modules have a maximum service life of about three years under ideal conditions. Replacement of these modules should be scheduled with the water system management when the flux decreases to an unacceptable limit and/or when the operating pressure requirements become excessive. Generally twenty to sixty-seven percent of the feed water is required to carry off the concentrated waste. The designer is cautioned that Hollow Fiber modules are sensitive to damage by chlorine.***

**(b) Design Criteria.**

(i) Pretreatment shall be provided per the manufacturer's recommendation.

***Guidance: PH adjustment of the feed water to pH 5.5 is recommended when cellulose acetate (spiral wound) modules are used. Softening or pH adjustment is satisfactory pretreatment for hollow fiber modules.***

(ii) Required equipment includes the following items: pressure gauges on the upstream and downstream side of the filter; a conductivity meter present at the site; taps for sampling permeate, concentrate and blended

flows (if practiced). If a continuous conductivity meter is permanently installed, piping shall be such that the meter can be disconnected and calibrated with standard solutions at a frequency as recommended by the manufacturer.

(iii) Aeration, if practiced, shall conform with provisions of R309-535-9.

(iv) Cleaning shall be routinely done in accordance with the manufacturer's recommendations.

(v) Where the feed water pH is altered, stabilization of the finished water is mandatory.

**(c) Waste Disposal.**
Waste generated by reverse osmosis treatment shall be disposed of in accordance with R309-525-23.

## (3) Electrodialysis.

**(a) General.**

***Guidance: Past electrodialysis units have experienced high maintenance cost relative to the two desalinization methods mentioned previously. Where maintenance is readily available, this method may be cost effective. Experience has shown stacks must be disassembled and cleaned every two-four weeks depending on the source quality and operating conditions. Generally ten to thirty percent of the feed water is required to carry off the concentrated waste products. The designer should be cautioned that electrodialysis membranes may be damaged by the presence of chlorine.***

**(b) Design.**

(i) Pretreatment shall be provided per the manufacturers recommendation.

***Guidance: Generally the same pretreatment necessary for reverse osmosis (R.O.) is required for electrodialysis. However, feed water may be heated to near 180 degrees Fahrenheit to improve performance and should be free of iron, manganese, or organics.***

(ii) The design shall include ability to: measure plant flow rates; measure feed temperature if the water is heated (a high temperature automatic cutoff is required to prevent membrane damage); measure D.C voltage at the first and second stages as well as on each of the stacks. Sampling taps

shall be provided to measure the conductivity of the feed water, blowdown water, and product water. D.C. and A.C. kilowatt-hour meters to record the electricity used shall also be provided.

**(c) Waste Disposal.**

Waste generated by electrodialysis treatment shall be disposed of in accordance with R309-525-23.

## *R309-535-9. Aeration.*

Part 4, Section 4.5, Aeration, in the Recommended Standards for Water Works (commonly known as "Ten State Standards"), 1997 edition, is hereby incorporated by reference and shall govern the design and operation of aeration facilities. This document is published by the Great Lakes-Upper Mississippi River Board of Public Health and Environmental Managers. A copy is available in the office of the Division for reference.

## *R309-535-10. Softening.*

Part 4, Section 4.4, Softening, in the Recommended Standards for Water Works (commonly known as "Ten State Standards"), 1997 edition, is hereby incorporated by reference and shall govern the design and operation of softening facilities. This document is published by the Great Lakes-Upper Mississippi River Board of Public Health and Environmental Managers. A copy is available in the office of the Division for reference.

## *R309-535-11. Iron and Manganese Control.*

Iron and manganese control, as used herein, refers solely to treatment processes designed specifically for this purpose. The treatment process used will depend upon the character of the source water. The selection of one or more treatment processes shall meet specific local conditions as determined by engineering investigations, including chemical analyses of representative samples of water to be treated, and receive approval of the Executive Secretary. It may be necessary to operate a pilot plant in order to gather all information pertinent to the design. Consideration should be given to adjust the pH of the raw water to increase the rate of the chemical reactions involved.

Removal or treatment of iron and manganese are normally by the following methods:

### (1) Removal by Oxidation, Detention and Filtration.

**(a) Oxidation.**

Oxidation may be by aeration, or by chemical oxidation with chlorine, potassium permanganate, ozone or chlorine dioxide.

**(b) Detention.**

(i) Reaction time - A minimum detention time of twenty minutes shall be provided following aeration in order to insure that the oxidation reactions are as complete as possible. This minimum detention may be omitted only where a pilot plant study indicates no need for detention. The detention basin shall be designed as a holding tank with no provisions for sludge collection but with sufficient baffling to prevent short circuiting.

(ii) Sedimentation - Sedimentation basins shall be provided when treating water with high iron and/or manganese content, or where chemical coagulation is used to reduce the load on the filters. Provisions for sludge removal shall be made.

**(c) Filtration.**

(i) General - Minimum criteria relative to number, rate of filtration, structural details and hydraulics, filter media, etc., provided for rapid rate gravity filters shall apply to pressure filters where appropriate, and may be used in this application but cannot be used in the filtration of surface waters or following lime-soda softening.

(ii) Details of Design for Pressure Filter - The filters shall be designed to provide for:

(A) Loss of head gauges on the inlet and outlet pipes of each filter,

(B) An easily readable meter or flow indicator on each battery of filters,

***Guidance: A flow indicator is recommended for each filtering unit.***

(C) Filtration and backwashing of each filter individually with an arrangement of piping as simple as possible to accomplish these purposes,

(D) The top of the washwater collectors to be at least twenty-four (24) inches above the surface of the media,

(E) The underdrain system to efficiently collect the filtered water and to uniformly distribute the backwash water at a rate capable of not less than 15 gpm/sf of filter area,

(F) Backwash flow indicators and controls that are easily readable while operating the control valves,

(G) An air release valve on the highest point of each filter,

(H) An accessible manhole to facilitate inspections and repairs,

(I) Means to observe the wastewater and filters during backwashing, and

(J) Construction to prevent cross-connection.

## (2) Removal by the Lime-soda Softening Process.

For removal by the lime-soda softening process refer to Part 4, Section 4.4, Softening, in the Recommended Standards for Water Works (commonly known as "Ten State Standards"), 1997 edition as indicated in R309-535-10.

## (3) Removal by Manganese Greensand Filtration.

This process, consisting of the continuous feed of potassium permanganate to the influent of a manganese greensand filter, is more applicable to the removal of manganese than the removal of iron.

(a) Provisions shall be made to apply the permanganate as far ahead of the filter as practical and at a point immediately before the filter.

***Guidance: Other oxidizing agents or processes such as chlorination or aeration may be used prior to the permanganate feed to reduce the cost.***

(b) An anthracite media cap of at least six inches shall be provided over manganese greensand.

(c) The normal filtration rate is three gpm/sf.

(d) The normal wash rate is 8 to 10 gpm/sf.

(e) Air washing shall be provided.

(f) Sample taps shall be provided:

(i) prior to application of permanganate,

(ii) immediately ahead of filtration,

(iii) at a point between the anthracite media and the manganese greensand,

(iv) halfway down the manganese greensand, and

(v) at the filter effluent.

## (4) Removal by Ion Exchange.

This process is not acceptable where either the source water or wash water contains dissolved oxygen.

***Guidance: This process of iron and manganese removal should not be used for water containing more than 0.3 milligrams per liter of iron, manganese or combination thereof.***

## (5) Sequestration by Polyphosphates.

This process shall not be used when iron, manganese or a combination thereof exceeds 1.0 milligram per liter. The total phosphate applied shall not exceed 10 milligrams per liter as $PO_4$. Where phosphate treatment is used, satisfactory chlorine residuals shall be maintained in the distribution system and the following required:

(a) feeding equipment shall conform to the requirements of R309-525-11(7),

(b) stock phosphate solution shall be kept covered and disinfected by carrying approximately 10 mg/l free chlorine residual,

(c) polyphosphates shall not be applied ahead of iron and manganese removal treatment. If no iron or manganese removal treatment is provided, the point of application shall be prior to any aeration, oxidation or disinfection steps, and

(d) phosphate chemicals must comply with ANSI/NSF Standard 60.

Sampling taps shall be provided for control purposes. Taps shall be located on each raw water source, and on each treatment unit influent and effluent.

Waste generated by iron and manganese control treatment shall be disposed of in accordance with R309-525-23.

## *R309-535-12. New Treatment Processes or Equipment.*

The policy of the Board is to encourage, rather than to obstruct, the development of new methods and equipment for the treatment of water. Nevertheless, any new processes or equipment must have been thoroughly tested in full-scale, comparable installations, before approval of plans can be issued. The U.S. Environmental Protection Agency (EPA) has created the Environmental Technology Verification (ETV) Program to facilitate the deployment of innovative or improved environmental technologies through performance verification and dissemination of information. NSF International (NSF) in cooperation with the EPA operates the Package Drinking Water Treatment Systems (PDWTS) pilot, one of 12 technology areas under ETV. Engineers and Manufacturers are referred to Bruce Bartley, Manager, ETV project, NSF International, P.O. Box 130140, Ann Arbor, Michigan 48113-0140.

***Guidance: Any municipality, water district, or institution purchasing novel equipment should be amply protected by a performance bond or other acceptable arrangement, so that any expenditure of money will be refunded in case of failure of any process or equipment. The performance bond should include provisions to cover the cost of any alterations deemed necessary by the Executive Secretary.***

No new treatment process will be approved for use in Utah unless the designer or supplier can present evidence satisfactory to the Executive Secretary that the process will insure the delivery of water of safe, sanitary quality, without imposing undue problems of supervision, operation and/or control.

**KEY: drinking water, miscellaneous treatment, stabilization, iron and manganese control**
**May 1, 2001** **19-4-104**

# R309-540 Pump Stations (Effective August 15, 2001)

## Table of Contents

# R309-540. Pump Stations.

## *R309-540-1. Purpose.*

The purpose of this rule is to provide specific requirements for pump stations utilized to deliver drinking water to facilities of public water systems. It is intended to be applied in conjunction with rules R309-500 through R309-550. Collectively, these rules govern the design, construction, operation and maintenance of public drinking water system facilities. These rules are intended to assure that such facilities are reliably capable of supplying adequate quantities of water which consistently meet applicable drinking water quality requirements and do not pose a threat to general public health.

## *R309-540-2. Authority.*

This rule is promulgated by the Drinking Water Board as authorized by Title 19, Environmental Quality Code, Chapter 4, Safe Drinking Water Act, Subsection 104(1)(a)(ii) of the Utah Code and in accordance with 63-46a of the same, known as the Administrative Rulemaking Act.

## *R309-540-3. Definitions.*

Definitions for certain terms used in this rule are given in R309-110 but may be further clarified herein.

## *R309-540-4. General.*

Pumping stations shall be designed to maintain the sanitary quality of water and to provide ample quantities of water at sufficient pressure.

## *R309-540-5. Pumping Facilities.*

### (1) Location.

(a) The pumping station shall be designed such that:

(i) the proposed site will meet the requirements for sanitary protection of water quality, hydraulics of the system, and protection against interruption of service by fire, flood or any other hazard;

***Guidance: Subsurface pits or pump rooms and inaccessible installations should be avoided.***

(ii) the access to the pump station shall be six inches above the surrounding ground and the station located at an elevation which is a minimum of three feet above the 100-year flood elevation, or three feet above the highest recorded flood elevation, which ever is higher, or protected to such elevations;

(iii) the station is readily accessible at all times unless permitted to be out of service for the period of inaccessibility;

(iv) surrounding ground is graded so as to lead surface drainage away from the station; and

(v) the station is protected to prevent vandalism and entrance by animals or unauthorized persons.

## (2) Pumping Stations.

(a) Building structures for both raw and drinking water shall:

(i) have adequate space for the installation of additional pumping units if needed, and for the safe servicing of all equipment;

(ii) be of durable construction, fire and weather resistant, with outward-opening doors;

(iii) have an interior floor elevation at least six inches above the exterior finished grade;

(iv) have any underground facilities, especially wet wells, waterproofed;

(v) have all interior floors drained in such a manner that the quality of drinking water contained in any wet wells will not be endangered. All floors shall slope at least one percent (one foot every 100 feet) to a suitable drain; and

(vi) provide a suitable outlet for drainage from pump glands without discharging onto the floor.

(b) Suction wells shall:

(i) be watertight;

(ii) have floors sloped to permit removal of water and entrained solids;

(iii) be covered or otherwise protected against contamination; and

(iv) have two pumping compartments or other means to allow the suction well to be taken out of service for inspection, maintenance, or repair.

(c) Servicing equipment shall consist of:

(i) crane-ways, hoist beams, eyebolts, or other adequate facilities for servicing or removal of pumps, motors or other heavy equipment;

(ii) openings in floors, roofs or wherever else needed for removal of heavy or bulky equipment; and

(iii) a convenient tool board, or other facilities as needed, for proper maintenance of the equipment.

(d) Stairways and ladders shall:

(i) be provided between all floors, and in pits or compartments which must be entered; and

(ii) have handrails on both sides, and treads of non-slip material. They shall have risers not exceeding nine inches and treads wide enough for safety.

***Guidance: Ramps are preferred in areas where there is frequent traffic or where supplies are transported by hand. Stairs, where ramps are not possible, and ladders as a last choice.***

(e) Heating provisions shall be adequate for:

(i) the comfort of the operator; and

(ii) the safe and efficient operation of the equipment.

***Guidance: In pump hoses not occupied by personnel, only enough heat need be provided to prevent freezing of equipment or treatment process.***

(f) Ventilation shall:

(i) conform to existing local and/or state codes; and

(ii) forced ventilation of at least six changes of air per hour shall be provided for all rooms, compartments, pits and other enclosures below

ground floor, and any area where unsafe atmosphere may develop or where excessive heat may be built up.

***Guidance: In areas where excess moisture could cause hazards to safety or damage to equipment , means for dehumidification should be provided.***

(g) Lighting.

Pump stations shall be adequately lighted throughout. All electrical work shall conform to the requirements of the relevant state and/or local building codes.

(h) Sanitary and other conveniences.

Plumbing shall be so installed as to prevent contamination of a public water supply. Wastes shall be discharged in accordance with the plumbing code, R317-4, or R317-1-3.

***Guidance: All pumping stations that are manned for extended periods should be provided with potable water, lavatory and toilet facilities.***

## (3) Pumps.

(a) Capacity. -Capacity shall be provided such that the pump or pumps shall be capable of providing the peak day demand of the system or the specific portion of the system serviced.

The pumping units shall:

(i) have ample capacity to supply the peak day demand against the required distribution system pressure without dangerous overloading;

(ii) be driven by prime movers able to meet the maximum horsepower condition of the pumps without use of service factors;

(iii) be provided readily available spare parts and tools; and

(iv) be served by control equipment that has proper heater and overload protection for air temperature encountered.

(b) Suction Lift.-Suction lift, where possible, shall be avoided. If suction lift is necessary, the required lift shall be within the pump manufacturer's recommended limits and provision shall be made for priming the pumps.

(c) Priming.-Prime water shall not be of lesser sanitary quality than that of the water being pumped. Means shall be provided to prevent back siphonage. When an air-operated ejector is used, the screened intake shall draw clean air from a point at least 10 feet above the ground or other source.

***Guidance: Vacuum priming may be used.***

## (4) Booster Pumps.

(a) Booster pumps shall be located or controlled so that:

(i) they will not produce negative pressure in their suction lines;

(ii) automatic cutoff pressure shall be at least 10 psi in the suction line;

(iii) automatic or remote control devices shall have a range between the start and cutoff pressure which will prevent excessive cycling; and

(iv) a bypass is available.

(b) Inline booster pumps (pumps withdrawing water directly from distribution lines without the benefit of storage and feeding such water directly into other distribution lines rather than storage), in addition to the other requirements of this section, shall have at least two pumping units (such that with any one pump out of service, the remaining pump or pumps shall be capable of providing the peak day demand of the specific portion of the system serviced), shall be accessible for servicing and repair and located or controlled so that the intake pressure shall be at least 20 psi when the pump or pumps are in normal operation.

***Guidance: All booster pumping stations should contain a totalizer meter.***

(c) Individual home booster pumps shall not be allowed for any individual service from the public water supply main.

***Guidance: Public water systems are responsible to adequately design and maintain their systems in order to deliver an adequate quantity of clean, safe, drinking water to their customers while maintaining a minimum pressure of 20 psi at all times, including peak demands (see R309-102-11 and R309-550-5).***

***Public water systems are being required to develop and operate a program to protect their systems from backflow or backsiphonage. An individual home booster pump, if installed such that the suction side of the pump draws directlyfrom the system's water main rather than through an intermediate holding tank, may reduce the pressure in the main to less than 20 psi (perhaps even creating a vacuum), thereby increasing the potential for contaminated***

***water to enter the distribution system through any minor undetected leaks that may exist.***

***We cannot regulate the individual homeowner, but we do not want to encourage public water systems to proliferate the use of such pumps. Rule R309-102-2.2 ("exceptions") will still be available for individual cases where there is no other acceptable alternative, but each public water system should review language included in their service agreements with customers and perhaps modify such as needed.***

## (5) Automatic and remote controlled stations.

All remote controlled stations shall be electrically operated and controlled and shall have signaling apparatus of proven performance. Installation of electrical equipment shall conform with the applicable state and local electrical codes and the National Electrical Code.

***Guidance: All automatic stations should be provided with automatic signaling apparatus which will report when the station is out of service.***

## (6) Appurtenances.

(a) Valves.-Valves shall be used to permit satisfactory operation, maintenance, and repair of the equipment. If foot valves are necessary, they shall have a net valve area of at least 2 1/2 times the area of the suction pipe and they shall have a positive-acting check valve on the discharge side between the pump and the shut-off valve.

(b) Piping.-Piping within and near pumping stations shall:

(i) be designed so that the friction losses will be minimized;

(ii) not be subject to contamination;

(iii) have watertight joints;

(iv) be protected against surge or water hammer; and

(v) be such that each pump has an individual suction line or that the lines shall be so manifolded that they will insure similar hydraulic and operating conditions.

(c) Gauges and Meters.-Each pump shall:

(i) have a standard pressure gauge on its discharge line;

(ii) have a compound gauge (capable of indicating negative pressure or vacuum as well as positive pressure) on its suction line; and

(iii) have recording gauges in the larger stations.

***Guidance: Pumping stations should have a means for measuring the discharge. The station should have indicating, totalizing, and recording metering of the total water pumped..***

(d) Water Seal.-Where pumps utilize water seals, the seals shall:

(i) not be supplied with water of a lesser sanitary quality than that of the water being pumped; and

(ii) when pumps are sealed with potable water and are pumping water of lesser sanitary quality, the seal shall be provided with a break tank open to atmospheric pressure, and have an air gap of at least six inches or two pipe diameters, whichever is greater, between the feeder line and the spill line of the tank.

(e) Controls.-Controls shall be designed in such a manner that they will operate their prime movers, and accessories, at the rated capacity without dangerous overload. Where two or more pumps are installed, provision shall be made for alternation. Provision shall be made to prevent energizing the motor in the event of a backspin cycle. Electrical controls shall be protected against flooding. Equipment shall be provided or other arrangements made to prevent surge pressures from activating controls which switch on pumps or activate other equipment outside the normal design cycle of operation.

(f) Standby Power.-Standby power, to ensure continuous service when the primary power has been interrupted, shall be provided from at least two independent sources or a standby or an auxiliary source shall be provided. If standby power is provided by onsite generators or engines, the fuel storage and fuel line must be designed to protect the water supply from contamination.

*Guidance: Because of the potential for contamination from leaking gasoline or diesel fuel tans, auxilliary on-site generators fueled by natural gas or bottled gas are preferred.*

(g) Water Pre-Lubrication.-When automatic pre-lubrication of pump bearings is necessary and an auxiliary direct drive power supply is provided, the pre-lubrication line shall be provided with a valved bypass around the automatic control so that the bearings can, if necessary, be lubricated manually before the

pump is started or the pre-lubrication controls shall be wired to the auxiliary power supply.

## *R309-540-6. Hydropneumatic Systems.*

### (1) General.

Hydropneumatic systems shall comply with all appropriate sections of R309-540-5.

***Guidance: Hydropneumatic systems including tanks, pumps compressors, piping and electrical switching equipment should generally be provided only for water systems serving less than 100 equivalent residential connections.***

Unpressurized ground level or elevated storage, designed in accordance with R309-545, shall be provided in addition to the diaphragm or air tanks. Diaphragm or air pressure tank storage shall not be considered for fire protection purposes or effective system storage.

***Guidance: Continuous duty variable frequency pumps may be an acceptable alternative for hydropneumatic systems if the designing engineer can demonstrate comparable performance and reliability.***

### (2) Location.

If diaphragm or air tanks and appurtenances are located below ground, adequate provisions for drainage, ventilation, maintenance, and flood protection shall be made and the electrical controls shall be located above grade so as to be protected from flooding as required by R309-540-5(6)(e). Any discharge piping from combination air release/vacuum relief valves(air/vac's) or pressure relief valves located in below ground chambers shall comply with all the pertinent requirements of R309-550-6(6).

***Guidance: The pressure tanks and appurtenances should be located above normal ground surface and be completely housed.***

***Guidance: The pressure tank or tanks and appurtenances may be separated.***

### (3) Operating Pressures.

The system shall be designed to provide a minimum of 20 psi pressure at all points in the distribution system during peak instantaneous flow conditions. A pressure gauge shall be installed on the pressure tank inlet line.

***Guidance: The system should operate with a 15-30 psi difference between the high and low pressures.***

## (4) Piping.

In addition to the bypass required by R309-540-5(4)(iv) on the pumps, the diaphragm or air tanks shall have sufficient bypass piping to permit operation of the hydropneumatic system while one or more of the tanks are being repaired or painted.

## (5) Pumps.

At least two pumping units shall be provided. With any pump out of service the remaining pump or pumps shall be capable of providing the peak instantaneous demand of the system as described in R309-510-9(2), while recharging the pressure tank at 115 percent of the upper pressure setting. Pump cycling shall not exceed 15 starts per hour, with a maximum of ten starts per hour preferred.

***Guidance: If the water system can be conveniently shut down (e.g.as in some non-community systems) one pump may be sufficient if approved by the Executive Secretary.***

## (6) Pressure Tanks.

(a) Pressure tanks shall meet the requirement of state and local laws and regulations for the manufacture and installation of unfired pressure vessels. Interior coatings or diaphragms used in pressure tanks that will come into contact with the drinking water shall comply with ANSI/NSF Standard 61. Non diaphragm pressure tanks shall have an access manhole, a drain, control equipment consisting of pressure gauge, water sight glass, automatic or manual air blow-off, means for adding air, and pressure operated start-stop controls for the pumps.

***Guidance: Sizing of hydropneumatic systems storage tanks, both unpressurized and pressure tanks, should consider the need for disinfectant detention time, as applicable, independant of the requirements of this section.***

***Guidance: Where practical the access manhole should be a minimum 24 inches in diameter.***

(b) The minimum volume of the pressure tank or combination of tanks shall be greater than or equal to the sum of S and the value of CX divided by 4W.

$$\text{Volume}_{(min)} >= S + CX/4W$$

where the following values are used in the equation above:

C = minutes per operating cycle, four minutes to meet the requirements of R309-540-6(5) above or preferably six minutes, and is equal to pump ON time plus pump OFF time.

X = output capacity rating of the pump(s) at the high pressure condition in the tank(s), in gpm.

W = percent of volume withdrawn during a given drop in tank pressure: specifically, between $P_h$ and $P_l$. $W = 100(P_h - P_l)/P_h$ where $P_h$ = high pressure in tank in psia (high absolute pressure) and $P_l$ = low pressure in tank is psia (low absolute pressure). Values of W range typically from 0.26 to 0.31 for pressure differentials of 15 to 30 psi and high system pressures of 45 to 85 psi at elevations of approximately 5,000 feet.

S = water seal volume in gallons, the volume of inactive water remaining in tank at low pressure condition.

***Guidance: As a rule-of-thumb the minimum volume (gallonage) of the hydropneumatic tank should be at least five times the capacity of the pump(s), rated in gpm. For example, a 200 gpm pump or combination of pumps should have a 1,000 gallon pressure tank.***

## (7) Air Volume.

The method of adjusting the air volume shall be acceptable to the Executive Secretary. Air delivered by compressors to the pressure tank shall be adequately filtered, oil free, and be of adequate volume. Any intake shall be screened and draw clean air from a point at least 10 feet above the ground or other source of possible contamination, unless the air is filtered by an apparatus approved by the Executive Secretary.

Discharge piping from air relief valves shall be designed and installed with screens to eliminate the possibility of contamination from this source.

## (8) Water Seal.

For air pressure tanks without an internal diaphragm the volume of water remaining in a air pressure tank at the lower pressure setting shall be sufficient to provide an adequate water seal at the outlet to prevent the leakage of air.

***Guidance: To prevent the formation of a vortex, a covering baffle may be installed over a vertical bottom outlet large enough to limit the peripheal velocity of approach to the baffle to 0.5 ft/sec of less. At low absolute pressure the depth of water over the top of the baffle should be about one outlet pipe velocity head or greater. For either horizontal or vertical outlets, the pipe outlet itself should be large enough to limit the maximum axial velocity in the pipe to 4.0 ft/sec or less. The use of anti-swirl vanes is always desirable.***

The following water seal depths shall be considered as minimum requirements.

(a) Horizontal outlets shall maintain sufficient depth, as measured from the centerline of the horizontal outlet pipe, such that the depth is greater than or equal to the sum of d and twice the value $v^2$ divided by 2G.

$$\text{depth} >= 2 (v^2/2G) + d$$

(b) Vertical outlets, if unbaffled, the depth shall be the same as in (a) except measured from the pipe outlet; if baffled, the depth shall be greater than or equal to the value $v^2$ divided by 2G.

$$\text{depth} >= v^2/2G$$

where the following values are used in the equations above:

v = the axial velocity in the pipe outlet for the peak instantaneous demand flow rate of the system.

d = the diameter of the outlet pipe in ft.

G = the gravitational constant of 32.2 ft/sec/sec.

***Guidance: The axial velocity in the pipe outlet should not exceed 4.0 ft/sec.***

## (9) Standby Power Supply.

Where a hydropneumatic system is intended to serve a public water system, categorized as a community water system as defined in R309-110, a standby source of power shall be provided.

**KEY: drinking water, pumps, hydropneumatic systems, individual home booster pumps**

**August 15, 2001** **19-4-104**

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# R309-545 Drinking Water Storage Tanks (Effective August 15, 2000)

## Table of Contents

# R309-545. Drinking Water Storage Tanks.

## *R309-545-1. Purpose.*

The purpose of this rule is to provide specific requirements for public drinking water storage tanks. It is intended to be applied in conjunction with other rules, specifically R309-500 through R309-550. Collectively, these rules govern the design, construction, operation and maintenance of public drinking water system facilities. These rules are intended to assure that such facilities are reliably capable of supplying adequate quantities of water which consistently meet applicable drinking water quality requirements and do not pose a threat to general public health.

## *R309-545-2. Authority.*

This rule is promulgated by the Drinking Water Board as authorized by Title 19, Environmental Quality Code, Chapter 4, Safe Drinking Water Act, Subsection 104(1)(a)(ii) of the Utah Code and in accordance with 63-46a of the same, known as the Administrative Rulemaking Act.

## *R309-545-3. Definitions.*

Definitions for certain terms used in this rule are given in R309-110 but may be further clarified herein.

## *R309-545-4. General.*

Storage for drinking water shall be provided as an integral part of each public drinking water system unless an exception to rule is approved by the Executive Secretary. Pipeline volume in transmission or distribution lines shall not be considered part of any storage volumes.

## *R309-545-5. Size of Tank(s).*

Required Storage Capacity: In the absence of firm water use data, at or above the 90% confidence level, storage tanks shall be sized in accordance with the recommended minimums of R309-510.

***Guidance: The storage requirements in R309-510 may be reduced or eliminated when the source and any treatment facility have sufficient capacity and reliability (e.g. dual pumps, standby power, etc.) To serve the peak hourly demands of the system plus fire flows. A request for an exception from rule, as described in R309-100-14, should be submitted along with records supporting the request and the exception approved, in writing, by the Executive Secretary before storage can be reduced or eliminated.***

## *R309-545-6. Tank Material and Structural Adequacy.*

### (1) Materials.

The materials used in drinking water storage structures shall provide stability and durability as well as protect the quality of the stored water.

### (2) Structural Design.

The structural design of drinking water storage structures shall be sufficient for the environment in which they are located. The design shall incorporate a careful analysis of potential seismic risks.

***Guidance: Division review of plans and specifications for storage tanks does not include an evaluation of structural suitability. Certificate of structural adequacy may be requested from the design engineer before approval is granted.***

## *R309-545-7. Location of Tanks.*

### (1) Pressure Considerations.

The location of the reservoir and the design of the water system shall be such that the minimum working pressure in the distribution system under peak day demand conditions, including fire flow, is 20 psi.

***Guidance: The normal working pressure should be between 40 and 60 psi. When static pressures exceed 80 psi, pressure reducing devices should be provided on mains in the distribution system, or individual home pressure reducing valves should be installed per the Utah Plumbing Code. The expected water level variation in the tank should be taken into account when considering minimum and maximum distribution system pressures.***

### (2) Connections.

Tanks shall be located at an elevation where present and anticipated connections can be adequately served. System connections shall not be placed at elevations such that a minimum of 20 psi cannot be continuously maintained.

### (3) Sewer Proximity.

Sewers, drains, standing water, and similar sources of possible contamination shall be kept at least 50 horizontal feet from the reservoir.

### (4) Standing Surface Water.

The area surrounding a ground-level drinking water storage structure shall be graded in a manner that will prevent surface water from standing within 50 horizontal feet of the structure.

### (5) Ability to Isolate.

Drinking water storage structures shall be designed and located so that they can be isolated from the distribution system. Storage structures shall be capable of being drained for cleaning or maintenance without necessitating loss of pressure in the distribution system.

***Guidance: It is recommended that any discharge lines from tank overflow or drains be sloped for complete drainage so as to prevent any standing water in these lines. It is also recommended that these lines be separate from each other as well as separate from other discharge lines, such as from perimeter french drain system, and each be easily visible as required for the overflow line.***

### (6) Earthquake and Landslide Risks.

Potential geologic hazards shall be taken into account in selecting a tank location. Earthquake and landslide risks shall be evaluated.

***Guidance: The design may include special shut-off or isolation valves designed to react in the event of an earthquake.***

### (7) Security.

The site location and design of a drinking water storage reservoir shall take into consideration security issues and potential for vandalism.

## *R309-545-8. Tank Burial.*

### (1) Flood Elevation.

The bottom of drinking water storage reservoirs shall be located at least three feet above the 100 year flood level or the highest known maximum flood elevation, whichever is higher.

***Guidance: The bottom should be placed at the normal ground surface when ever possible.***

### (2) Ground Water.

When the bottom of a drinking water storage reservoir is to be below normal ground surface, it shall be placed above the local ground water table elevation.

***Guidance: It is recommended that a french drain system be considered around any buried storage tank, but especially if the ground water table elevation is unknown or may exhibit seasonal variations.***

### (3) Covered Roof.

When the roof of a drinking water storage reservoir is to be covered by earth, the roof shall be sloped to drain toward the outside edge of the tank.

## *R309-545-9. Tank Roof and Sidewalls.*

### (1) Protection From Contamination.

All drinking water storage structures shall have suitable watertight roofs and sidewalls which shall also exclude birds, animals, insects, and excessive dust.

### (2) Openings.

Openings in the roof and sidewalls shall be kept to a minimum and comply with the following:

(a) Any pipes running through the roof or sidewall of a metal drinking water storage structure shall be welded, or properly gasketed. In new concrete tanks, these pipes shall be connected to standard wall castings with seepage rings which have been poured in place. Vent pipes, in additions to seepage rings, shall have raised concrete curbs which direct water away from the vent pipe and are formed as a single pour with the roof deck. No roof drains or any other pipes which may

contain water of less quality than drinking water shall ever penetrate the roof, walls, or floor of a drinking water storage tank.

(b) Openings in a storage structure roof or top, designated to accommodate control apparatus or pump columns, shall be welded, gasketed, or curbed and sleeved as above, and shall have additional proper shielding to prevent vandalism.

***Guidance: Valves and controls should be located outside the storage structure so that the valve stems and similar projections will not pass through the roof or top of the reservoir.***

(c) Openings shall be kept as far away as possible from the storage tank outlet and other sources of surface water.

### (3) Adjacent Compartments.

Drinking water shall not be stored or conveyed in a compartment adjacent to wastewater when the two compartments are separated by a single wall.

### (4) Slope of Roof.

The roof of all storage structures shall be designed for drainage. Parapets, or similar construction which would tend to hold water and snow, shall not be utilized unless adequate waterproofing and drainage are provided. Downspout or roof drain pipes shall not enter or pass through the reservoir.

## *R309-545-10. Internal Features.*

***Guidance: A means should be provided for the draining of drinking water storage structures that is separate from the normal outlet pipeline. The floor of the storage structure should be sloped to permit complete drainage of the structure. Also the maximum variation between high and low water levels in storage structures, providing pressure to a distribution system, should not exceed 30 feet***.

The following shall apply to internal features of drinking water storage structures:

### (1) Drains.

If a drain is provided, it shall not discharge to a sanitary sewer. If local authority allows discharge to a storm drain, the drain discharge shall have a physical air gap of at least two

pipe diameters between the discharge end of the pipe and the overflow rim of the receiving basin.

### (2) Internal Catwalks.

Internal catwalks, if provided and located so as to be over the drinking water, shall have a solid floor with raised edges. The edges and floor shall be so designed that shoe scrapings or dirt will not fall into the drinking water.

### (3) Inlet and Outlet.

To minimize potential sediment flow from the structure, the normal outlet pipes from all reservoirs shall be located in a manner to provide a silt trap prior to discharge into the distribution system.

***Guidance: Where separate drains are not provided, removable silt stops should be provided on reservoir discharge pipes.***

### (4) Disinfection.

If the drinking water reservoir is to be utilized as a contact basin for disinfection purposes, the design engineer shall conduct tracer studies or other tests, previously approved by the Executive Secretary, to determine the minimum contact time and the potential for short circuiting.

***Guidance: In order to minimize short circuiting and to maximize the effectiveness of any disinfection process, inlet and outlet pipes should be as distant from one another as possible. Internal baffling may also be needed in order to minimize the possibility of short circuiting through the tank.***

## *R309-545-11. ANSI/NSF International, Standard 61.*

### (1) ANSI/NSF Standard 61 Certification.

All interior surfaces or coatings shall consist of products which are certified by laboratories approved by ANSI and which comply with ANSI/NSF Standard 61 or other standards approved by the Executive Secretary. This requirement applies to any pipes and fittings, protective materials (e.g. paints, coatings, concrete admixtures, concrete release agents, concrete sealers), joining and sealing materials (e.g. adhesives, caulks,

gaskets, primers and sealants) and mechanical devices (e.g. electrical wire, switches, sensors, valves, submersible pumps) which are located so as to come into contact with the drinking water.

***Guidance: If it can be shown to the satisfaction of the Executive Secretary that flushing, swabbing, cleaning and disinfection procedures will adequately flush a coating (e.g. release agents, curing compounds, etc.) from the tank leaving no residual exceeding any MCL, the Executive Secretary may accept it's use. Prior to placing a drinking water storage reservoir back in service, where products not certified to ANSI/NSF Standard 61 are utilized, the Executive Secretary may require sampling and testing for a specific compound or ingredient based upon the product used.***

### (2) Curing Time and Volatile Organic Compounds.

If products which require a cure or set time are utilized in such a way as to come into contact with the drinking water, then water shall not be introduced into the vessel until any required curing time has passed. It shall be the responsibility of the water purveyor to assure that no tastes or odors, toxins or other compounds, which result in MCL exceedances, are imparted to the water as a result of tank repair.

***Guidance: Prior to placing a drinking water storage reservoir back in service, an analysis for volatile organic compounds from water contained therein is advisable to establish that no such compounds have leached into the water.***

## *R309-545-12. Steel Tanks.*

### (1) Paints.

Proper protection shall be given to all metal surfaces, both internal and external, by paints or other protective coatings. Internal coatings shall comply with ANSI/NSF Standard 61.

### (2) Cathodic Protection.

If installed, internal cathodic protection shall be designed, installed and maintained by personnel trained in corrosion engineering.

## *R309-545-13. Tank Overflow.*

All water storage structures shall be provided with an overflow which is discharged at an elevation between 12 and 24 inches above the ground surface with an appropriate air gap. The discharges shall not cause erosion.

### (1) Diameter.

All overflow pipes shall be of sufficient capacity to permit waste of water in excess of the filling rate.

### (2) Slope.

All overflow pipes shall be sloped for complete drainage,

### (3) Screen.

All overflow pipes shall be screened with No. 4 mesh non-corrodible screen installed at a location least susceptible to damage by vandalism,

### (4) Visible Discharge.

All overflow pipes shall be located so that any discharge is visible,

### (5) Cross Connections.

All overflow pipes shall not be connected to, or discharge into, any sanitary sewer system.

***Guidance: Discharge into a storm drain system may be allowed if local authority approval is obtained and an appropriate air gap as described in R309-210-10(1) is provided.***

### (6) Paint.

If an overflow pipe within a reservoir is painted or otherwise coated, such coating shall comply with ANSI/NSF Standard 61.

## *R309-545-14. Access Openings.*

Drinking water storage structures shall be designed with reasonably convenient access to the interior for cleaning and maintenance.

***Guidance: When considering what is reasonably convenient, the design engineer should consider that it may be necessary for one individual to open the access. The access should be hinged at one side, and counter-weighted if the lid is in excess of 60 pounds.***

### (1) Height.

There shall be at least one opening above the water line which shall be framed at least four inches above the surface of the roof at the opening; or if on a buried structure, shall be elevated at least 18 inches above any earthen cover over the structure. The frame shall be securely fastened and sealed to the tank roof so as to prevent any liquid contaminant entering the tank. Concrete drinking water storage structures shall have raised curbs around access openings, formed and poured continuous with the pouring of the roof and sloped to direct water away from the frame.

***Guidance: It is preferable that access openings be framed higher than the four inches required above, and if located in areas subject to heavy snows, be more in the area of 24 to 36 inches.***

### (2) Shoebox Lid.

The frame of any access opening shall be provided with a close fitting solid shoebox type cover which extends down around the frame at least two inches and is furnished with a gasket(s) between the lid and frame,

### (3) Locking Device.

The lid to any access opening shall have a locking device.

## *R309-545-15. Venting.*

Drinking water storage structures shall be vented. Overflows shall not be considered as vents. Vents provided on drinking water storage reservoirs shall:

### (1) Inverted Vent.

Be downturned or shielded to prevent the entrance of surface water and rainwater.

### (2) Open Discharge.

On buried structures, have the discharge 24 to 36 inches above the earthen covering.

### (3) Blockage.

Be located and sized so as to avoid blockage during winter conditions.

### (4) Pests.

Exclude birds and animals.

### (5) Dust.

Exclude insects and dust, as much as this function can be made compatible with effective venting.

### (6) Screen.

Be fitted with No. 14 mesh or finer non-corrodible screen.

### (7) Screen Protector.

Be fitted with additional heavy gage screen or substantial covering which will protect the No. 14 mesh screen against vandalism and, further, discourage purposeful attempts to contaminate the reservoir.

## *R309-545-16. Freezing Prevention.*

All drinking water storage structures and their appurtenances, especially the riser pipes, overflows, and vents, shall be designed to prevent freezing which may interfere with proper functioning.

## *R309-545-17. Level Controls.*

Adequate level control devices shall be provided to maintain water levels in storage structures.

***Guidance: Where appropriate, pumps should be controlled from tank levels with the signal transmitted by telemetry equipment. Telemetry controls and other electrical components should not be located in below grade vaults subject to flooding from the surface or by pipeline breaks. Altitude valves or equivalent controls may be required for subsequent storage structures on the system. Level indicating devices should be provided at a central location.***

***Overflow and low- level warnings or alarms should be located at places in the community where they will be under responsible surveillance 24 hours a day.***

## *R309-545-18. Security.*

Locks on access manholes, and other necessary precautions shall be provided to prevent unauthorized entrance, vandalism, or sabotage.

***Guidance: Fencing is advisable where the reservoir is highly accessible to the public or livestock. Where electricity or telemetry is available, consideration should be given to the installation of electronic security equipment.***

## *R309-545-19. Safety.*

### (1) Utah OSHA.

The safety of employees shall be considered in the design of the storage structure. Ladders, ladder guards, platform railings, and safely located entrance hatches shall be provided where applicable. As a minimum, such matters shall conform to pertinent laws and regulations of the Utah Occupational Safety and Health Administration.

### (2) Ladders.

Generally, ladders having an unbroken length in excess of 20 feet shall be provided with appropriate safety devices. This requirement shall apply both to interior and exterior reservoir ladders.

### (3) Requirements for Elevated Tanks.

Elevated tanks shall have railings or handholds provided for transfer from the access tube to the water compartment.

## *R309-545-20. Disinfection.*

Drinking water storage structures shall be disinfected before being put into service for the first time, and after being entered for cleaning, repair, or painting. The reservoir shall be cleaned of all refuse and shall then be washed with potable water prior to adding the disinfectant. AWWA Standard C652-92 shall be followed for reservoir disinfection, with the exception there shall be no delivery of waters used in the disinfection process to the distribution system, unless specifically authorized, in writing, by the Executive Secretary.

Upon completing any of the three methods for storage tank chlorination, as outlined in AWWA C652-92, the water system must properly dispose of residual super-chlorinated waters in the outlet pipes. Other super-chlorinated waters, which are not to be ultimately diluted and delivered into the distribution system, shall also be properly disposed.

***Guidance: The Executive Secretary may require sampling and analysis of water prior to authorizing it's delivery into a distribution system.***

Chlorinated water discharged from the storage tank shall be disposed of in an acceptable manner and in conformance with the rules of the Utah Water Quality Board (see R317 of the Utah Administrative Code).

## *R309-545-21. Incorporation by Reference.*

The following list of Standards shall be considered as incorporated by reference in this specific rule. The most recent published copy of the referenced standard will apply in each case.

### (1) AWWA Standards.

(a) C652-92, Disinfection of Water Storage Reservoirs.

(b) D100-96, Welded Steel Tanks for Water Storage.

(c) D101-53(R86), Inspecting and Repairing Steel Water Tanks, Standpipes, Reservoirs, and Elevated Tanks for Water Storage.

(d) D102-97, Coating Steel Water-Storage Tanks.

(e) D103-97, Factory-Coated Bolted Steel Tanks for Water Storage.

(f) D104-97, Automatically Controlled, Impressed-Current Cathodic Protection for the Interior of Steel Water Tanks.

(g) D110-95, Wire-Wound Circular Prestressed-Concrete Water Tanks (including addendum D110a-96).

(h) D115-95, Circular Prestressed Concrete Water Tanks With Circumferential Tendons.

(i) D120-84(R89), Thermosetting Fiberglass-Reinforced Plastic Tanks.

(j) D130-96, Flexible-Membrane-Lining and Floating-Cover Materials for Potable-Water Storage.

### (2) NSF International Standards.

(a) NSF 60, Drinking Water Treatment Chemicals - Health Effects.

(b) NSF 61, Drinking Water System Components - Health Effects.

### (3) Utah OSHA.

Applicable standards of the Utah Occupational Safety and Health Administration are hereby incorporated by reference

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## *R309-545-22. Operation and Maintenance of Storage Tanks.*

### (1) Inspection and Cleaning.

Tanks which are entered for inspection and cleaning shall be disinfected in accordance with AWWA Standard C652-92 prior to being returned to service. When diver(s) enter storage tanks that have not been drained for inspection purposes, they shall comply with section five of the above standard unless the tank is constructed of steel, in which case they shall comply additionally with AWWA Standard D101-53(R86).

### (2) Recoating or Repairing.

Any substance used to recoat or repair the interior of drinking water storage tank shall be certified to conform with ANSI/NSF Standard 61. If the tank is not drained for recoating or repairing, any substance or material used to repair interior coatings or cracks shall be suitable for underwater application, as indicated by the manufacturer, as well as comply with both ANSI/NSF Standards 60 and 61.

### (3) Seasonal Use.

Water storage tanks which are operated seasonally shall be flushed and disinfected in accordance with AWWA Standard C652-92 prior to each season's use. Certification of proper disinfection, as evidenced by at least one satisfactory bacteriologic sample, shall be obtained by the system management and kept on file for inspection by personnel of the Division. During the non-use period, care shall be taken to see that openings to the water storage tank (those which are normally closed and sealed during normal use) are closed and secured.

**KEY: drinking water, storage tanks, access, overflow and drains**
**August 15, 2000** **19-4-104**

# R309-550 Transmission and Distribution Pipelines (Effective August 15, 2001)

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# R309-550. Transmission and Distribution Pipelines.

## *R309-550-1. Purpose.*

The purpose of this rule is to provide specific requirements for the design and installation of transmission and distribution pipelines which are utilized to deliver culinary drinking water to facilities of public drinking water systems or to consumers. It is intended to be applied in conjunction with rules R309-500 through R309-550. Collectively, these rules govern the design, construction, operation and maintenance of public drinking water system facilities. These rules are intended to assure that such facilities are reliably capable of supplying adequate quantities of water which consistently meet applicable drinking water quality requirements and do not pose a threat to general public health.

## *R309-550-2. Authority.*

This rule is promulgated by the Drinking Water Board as authorized by Title 19, Environmental Quality Code, Chapter 4, Safe Drinking Water Act, Subsection 104(1)(a)(ii) of the Utah Code and in accordance with 63-46a of the same, known as the Administrative Rulemaking Act.

## *R309-550-3. Definitions.*

Definitions for certain terms used in this rule are given in R309-110 but may be further clarified herein.

## *R309-550-4. General.*

Transmission and distribution pipelines shall be designed, constructed and operated to convey adequate quantities of water at ample pressure, while maintaining water quality.

## *R309-550-5. Water Main Design.*

### (1) Distribution System Pressure.

The distribution system shall be designed to maintain a minimum pressure of 20 psi (at ground level) at all points of connection, under all conditions of flow, but especially during peak day flow conditions, including fire flows.

***Guidance: The normal working pressure in the distribution system should be between 40 and 60 psi. When static pressure exceed 80 psi, pressure reducing devices should be***

***provided on mains in the distribution system, or individual home pressure reducing valves should be installed per the Utah Plumbing Code.***

## (2) Assumed Flow Rates.

Flow rates to be assumed when designing or analyzing distribution systems shall be as given in R309-510 of these rules.

## (3) Computerized Network Analysis.

(a) All water mains shall be sized after a hydraulic analysis based on flow demands and pressure requirements. If the calculations needed to conduct this hydraulic analysis are complex, a computerized network analysis shall be performed to verify that the distribution system will be capable of meeting the requirements of this rule.

(b) Where improvements will upgrade more than 50% of an existing distribution system, or where a new distribution system is proposed, a hydraulic analysis of the entire system shall be prepared and submitted for review prior to plan approval.

(c) In the analysis and design of water distribution systems, the following Hazen-William coefficients shall be used: PVC pipe = 140; Ductile Iron Pipe = 120; Cement-Mortar Lined Ductile Iron Pipe = 130 to 140.

## (4) Minimum Water Main Size.

For water mains not connected to fire hydrants, the minimum line size shall be 4-inch diameter. Minimum water main size serving a fire hydrant lateral shall be 8-inch diameter unless a hydraulic analysis indicates that required flow and pressures can be maintained by smaller lines.

***Guidance: Generally, velocity in a water main should not exceed 5 fps. Mains should be designed with sufficient excess capacity to provide for anticipated future connections.***

## (5) Fire Protection.

(a) The design of the distribution system shall be consistent with Appendix III-A and III-B of the 1991 Uniform Fire Code. As specified in this code, minimum fire-flow requirements are:

(i) 1000 gpm for one- and two-family dwellings with an area of less than 3600 square feet.

(ii) 1500 gpm or greater for all other buildings.

(b) The location of fire hydrants shall be consistent with Appendix III-B of the 1991 Uniform Fire Code. As specified in this code, average spacing between hydrants must be no greater than 500 ft.

***Guidance: Generally, individual hydrant spacing may range from 350 to 600 feet depending on the area being served. Hydrants should be provided at each street intersection and at intermediate points between intersection. The planning of hydrant locations should be a cooperative effort between the water utility and local fire officials.***

(c) An exception to the fire protection requirements of (a) and (b) may be granted if a suitable statement is received from the local fire protection authority.

(d) Water mains not designed to carry fire flows shall not have fire hydrants connected to them.

(e) The design engineer shall verify that the pipe network design permits fire-flows to be met at representative locations while a minimum pressure of 20 psi is maintained at all times and at all points in the distribution system.

***Guidance: For guidance on conducting this analysis, refer to AWWA Manual M31, Distribution System Requirements for Fire Protection.***

(f) As a minimum, the flows to be assumed during a fire-flow analysis shall be the "peak day demand" plus the fire flow requirement.

***Guidance: See section 309-510-5 for information on how to estimate the "peak day demand" for various types of public water supplies.***

## (6) Geologic Considerations.

The character of the soil through which water mains are to be laid shall be considered. This information shall accompany any submittal for a pipeline project.

***Guidance: If possible, pipelines should not be laid in areas of unusual geologic hazard (e.g. slide zones, fault zones, etc.) Where these areas are impossible to avoid, special design and buriel techniqes should be employed. IN areas of high earthquake hazard, it is recommended that pipe be of a type least vulnerable to damage by earthquake, such as ductile-iron and PVC pipe.***

## (7) Dead Ends.

(a) In order to provide increased reliability of service and reduce head loss, dead ends shall be minimized by making appropriate tie-ins whenever practical.

(b) Where dead-end mains occur, they shall be provided with a fire hydrant if flow and pressure are sufficient, or with an approved flushing hydrant or blow-off for flushing purposes. Flushing devices shall be sized to provide flows which will give a velocity of at least 2.5 fps in the water main being flushed. No flushing device shall be directly connected to any sewer.

## (8) Valves.

Sufficient valves shall be provided on water mains so that inconvenience and sanitary hazards will be minimized during repairs. Valves shall be located at not more than 500 foot intervals in commercial districts and at not more than one block or 800 foot intervals in other districts. Where systems serve widely scattered customers and where future development is not expected, the valve spacing shall not exceed one mile.

## (9) Corrosive Soils.

The design engineer shall consider the materials to be used when corrosive soils or waters will be encountered.

***Guidance: Where severe corrosion is indicated, approved plastic pipe is recommended***.

## (10) Special Precautions in Areas of Groundwater Contamination by Organic Compounds.

Where distribution systems are installed in areas of groundwater contaminated by organic compounds:

(a) pipe and joint materials which are not subject to permeation of the organic compounds shall be used.

(b) non-permeable materials shall be used for all portions of the system including water main, service connections and hydrants leads.

## (11) Separation of Water Mains from Other Sources of Contamination.

Design engineers shall exercise caution when locating water mains at or near certain sites such as sewage treatment plants or industrial complexes. Individual septic tanks shall be located and avoided. The engineer shall contact the Division to establish specific design requirements for locating water mains near any source of contamination.

## *R309-550-6. Component Materials and Design.*

### (1) NSF Standard for Health Effects.

All materials which may contact drinking water, including pipes, gaskets, lubricants and O-Rings, shall be ANSI-certified as meeting the requirements of NSF Standard 61, Drinking Water System Components - Health Effects. To permit field-verification of this certification, all such components shall be appropriately stamped with the NSF logo.

### (2) Restrictions on Asbestos and Lead.

(a) The use of asbestos cement pipe shall not be allowed.

(b) Pipes and pipe fittings containing more than 8% lead shall not be used. Lead-tip gaskets shall not be used. Repairs to lead-joint pipe shall be made using alternative methods.

### (3) AWWA Standards for Mechanical Properties.

Pipe, joints, fittings, valves and fire hydrants shall conform to NSF Standard 61 or Standard 14, and applicable sections of ANSI/AWWA Standards C104-95 through C550-90 and C900-97 through C950-95.

### (4) Used Materials.

Only materials which have been used previously for conveying potable water may be reused. Used materials shall meet the above standards, be thoroughly cleaned, and be restored practically to their original condition.

### (5) Fire Hydrant Design.

***Guidance: Fire hydrants should have a bottom valve size of at least five inches, one 4.5 inch pumper nozzle and two 2.5 in nozzles.***

***Guidance: The hydrant lead should be a minimum of six inches in diameter. Auxiliary valves should be installed in all hydrant leads.***

Hydrant drains shall not be connected to or located within 10 feet of sanitary sewers or storm drains.

***Guidance: Hydrant drains should be plugged. When the drains are plugged, the barrels should be pumped dry after use during freezing weather. Where hydrant drains are not plugged, a gravel pocket or dry well should be provided unless the natural soils will provide adequate drainage.***

## (6) Air Relief Valves.

At high points in water mains where air can accumulate, provisions shall be made to remove air by means of hydrants or air relief valves. Automatic air relief valves shall not be used in situations where flooding may occur.

***Guidance: The air relief valve should be placed so as to prevent problems due to freezing. A shut-off valve should be provided to permit servicing of any air relief valve.***

(a) Air Relief Valve Vent Piping.- The open end of an air relief vent pipe from automatic valves shall, where possible as determined by public water system management, be extended to at least one foot above grade and provided with a screened (#14 mesh, non-corrodible) downward elbow. Alternately, the open end of the pipe may be extended to as little as one foot above the top of the pipe if the valve's chamber is not subject to flooding and provided with a drain-to-daylight (See (b) below). Blow-offs or air relief valves shall not be connected directly to any sewer.

(b) Chamber Drainage - Chambers, pits or manholes containing valves, blow-offs, meters, other such appurtenances to a distribution system, shall not be connected directly to any storm drain or sanitary sewer. They shall be provided with a drain to daylight. Where this is not possible, underground gravel filled absorption pits may be used if the site is not subject to flooding and conditions will assure adequate drainage. Where a chamber contains an air relief valve, and it is not possible to provide a drain-to-daylight, the vent pipe from the valve shall be extended to at least one foot above grade (See (a) above). Only when it is both impossible to extend the vent pipe above grade, and impossible to provide a drain-to-daylight may a gravel filled sump be utilized to provide chamber drainage (assuming local ground conditions permit adequate drainage without ground water intrusion).

***Guidance: PVC Pipe Considerations. Consideration should be given to placing tracer tape on PVC pipe to permit location of the pipe by available detection equipment. Furthermore,***

***systems subject to severe freezing episodes should consider that a typical method for thawing pipe requires metal pipe.***

## *R309-550-7. Separation of Water Mains and Transmission Lines from Sewers and Other Pollution Sources.*

### (1) Basic Separation Standards.

The horizontal distance between pressure water mains and sanitary sewer lines shall be at least ten feet. Where a water main and a sewer line must cross, the water main shall be at least 18 inches above the sewer line. Separation distances shall be measured edge-to-edge (i.e. from the nearest edges of the facilities). Water mains and sewer lines shall not be installed in the same trench.

### (2) Exceptions to Basic Separation Standards.

Local conditions, such as available space, limited slope, existing structures, etc., may create a situation where there is no alternative but to install water mains or sewer lines at a distance less than that required by Subsection (1), above. Exceptions to the rule may be provided by the Executive Secretary if it can be shown that the granting of such an exception will not jeopardize the public health.

### (3) Special Provisions.

The following special provisions apply to all situations:

(a) The basic separation standards are applicable under normal conditions for sewage collection lines and water distribution mains. More stringent requirements may be necessary if conditions such as high groundwater exist.

(b) Sewer lines shall not be installed within 25 feet horizontally of a low head (5 psi or less pressure) water main.

(c) Sewer lines shall not be installed within 50 feet horizontally of any transmission line segment which may become unpressurized.

(d) New water mains and sewers shall be pressure tested where the conduits are located ten feet apart or less.

(e) In the installation of water mains or sewer lines, measures shall be taken to prevent or minimize disturbances of the existing line.

(f) Special consideration shall be given to the selection of pipe materials if corrosive conditions are likely to exist. These conditions may be due to soil type and/or the nature of the fluid conveyed in the conduit, such as a septic sewage which produces corrosive hydrogen sulfide.

(g) Sewer Force Mains

(i) Sewer force mains shall not be installed within ten feet (horizontally) of a water main.

(ii) When a sewer force main must cross a water line, the crossing shall be as close as practical to the perpendicular. The sewer force main shall be at least 18 inches below the water line.

(iii) When a new sewer force main crosses under an existing water main, all portions of the sewer force main within ten feet (horizontally) of the water main shall be enclosed in a continuous sleeve.

(iv) When a new water main crosses over an existing sewer force main, the water main shall be constructed of pipe materials with a minimum rated working pressure of 200 psi or equivalent pressure rating.

### (4) Water Service Laterals Crossing Sewer Mains and Laterals.

Water service laterals shall conform to all requirements given herein for the separation of water and sewer lines.

## *R309-550-8. Installation of Water Mains.*

### (1) Standards.

(a) The specifications shall incorporate the provisions of the manufacturer's recommended installation procedures or the following standards:

(i) AWWA Standard C600-99, Installation of Ductile Iron Water Mains and Their Appurtenances

(ii) ASTM D2774, Recommended Practice for Underground Installation of Thermoplastic Pressure Piping and PVC Pipe

(b) The provisions of the following publication shall be followed for PVC pipe design and installation:

PVC Pipe - Design and Installation, AWWA Manual M23, 1990, published by the American Water Works Association

## (2) Bedding.

A continuous and uniform bedding shall be provided in the trench for all buried pipe. Stones larger than the backfill materials described below shall be removed for a depth of at least six inches below the bottom of the pipe.

## (3) Backfill.

Backfill material shall be tamped in layers around the pipe and to a sufficient height above the pipe to adequately support and protect the pipe. The material and backfill zones shall be as specified by the standards referenced in Subsection (1), above. As a minimum:

(a) For plastic pipe, backfill material with a maximum particle size of 3/4 inch shall be used to surround the pipe.

(b) For ductile iron pipe, backfill material shall contain no stones larger than 2 inches.

## (4) Dropping Pipe into Trench.

Under no circumstances shall the pipe or accessories be dropped into the trench.

## (5) Burial Cover.

All water mains shall be covered with sufficient earth or other insulation to prevent freezing unless they are part of a non-community system that can be shut-down and drained during winter months when temperatures are below freezing.

***Guidance: Pipe should be buried at least 12 inches below maximum expected frost penetration. The following is a list of reported pipe burial depths in Utah which may serve as a guide in this respect:***

***(A) Logan - 5ft.***
***(B) Salt Lake City - 3.5 ft. (5 ft. in high benches)***
***(C) Alta/Snowbird - 6 ft. (7 ft. if under roadway)***
***(D) St. George - 3ft.***

***(E) Park City - 5ft. (7 ft. above 7000 ft. elevation)***
***(F) Richfield - 4 ft.***
***(G) Moab - 4 ft.***

## (6) Thrust Blocking.

All tees, bends, plugs and hydrants shall be provided with reaction blocking, tie rods or joints designed to prevent movement.

## (7) Pressure and Leakage Testing.

All types of installed pipe shall be pressure tested and leakage tested in accordance with AWWA Standard C600-99.

## (8) Surface Water Crossings.

***Guidance: Surface water crossings, whether over or under water, present special problems; the Division should be consulted before final plans are prepared.***

**(a) Above Water Crossings**

The pipe shall be adequately supported and anchored, protected from damage and freezing, and accessible for repair or replacement.

**(b) Underwater Crossings**

A minimum cover of two feet or greater, as local conditions may dictate, shall be provided over the pipe. When crossing water courses which are greater than 15 feet in width, the following shall be provided:

(i) The pipe shall be of special construction, having restrained joints for any joints within the surface water course and flexible restrained joints at both edges of the water course.

(ii) Valves shall be provided at both ends of water crossings so that the section can be isolated for testing or repair; the valves shall be easily accessible, and not subject to flooding; and the valve nearest to the supply source shall be in a manhole.

(iii) Permanent taps shall be made on each side of the valve within the manhole to allow insertion of testing equipment to determine leakage and for sampling purposes.

### (9) Sealing Pipe Ends During Construction.

The open ends of all pipeline under construction shall be covered and effectively sealed at the end of the day's work.

### (10) Disinfecting Water Distribution Systems.

All new water mains or appurtenances shall be disinfected in accordance with AWWA Standard C651-99. The specifications shall include detailed procedures for the adequate flushing, disinfection and microbiological testing of all water mains. On all new and extensive distribution system construction, evidence of satisfactory disinfection shall be provided to the Division. Samples for coliform analyses shall be collected after disinfection is complete and the system is refilled with potable water. A standard heterotrophic plate count is advisable. The use of water for culinary purposes shall not commence until the bacteriologic tests indicate the water to be free from contamination.

## *R309-550-9. Cross Connections and Interconnections.*

### (1) Physical Cross Connections.

There shall be no physical cross connections between the distribution system and pipe, pumps, hydrants, or tanks which are supplied from, or which may be supplied or contaminated from, any source except as approved by the Executive Secretary.

### (2) Recycled Water.

Neither steam condensate nor cooling water from engine jackets or other heat exchange devices shall be returned to the potable water supply.

### (3) System Interconnects.

The approval of the Executive Secretary shall be obtained for interconnections between different potable water supply systems.

## *R309-550-10. Water Hauling.*

Water hauling is not an acceptable permanent method for culinary water distribution in community water systems. Proposals for water hauling shall be submitted to and approved by the Executive Secretary.

### (1) Exceptions.

The Executive Secretary may allow its use for non-community public water supplies if:

(a) consumers could not otherwise be supplied with good quality drinking water, or

(b) the nature of the development, or ground conditions, are such that the placement of a pipe distribution system is not justified.

### (2) Emergencies.

Hauling may also be necessary as a temporary means of providing culinary water in an emergency.

***Guidance: The guidelines for water hauling are contained in the bulletin entitled "Recommended Procedures for Hauling Culinary Water" available from the Division.***

## *R309-550-11. Service Connections and Plumbing.*

### (1) Service Taps.

Service taps shall be made so as to not jeopardize the sanitary quality of the system's water.

### (2) Plumbing.

(a) Service lines shall be capped until used.

(b) Water services and plumbing shall conform to the Utah Plumbing Code. Solders and flux containing more than 0.2% lead and pipe and pipe fittings containing more than 8% lead shall not be used.

### (3) Individual Home Booster Pumps.

Individual booster pumps shall not be allowed for any individual service from the public water supply mains. Exceptions to the rule may be provided by the Executive Secretary

if it can be shown that the granting of such an exception will not jeopardize the public health.

***Guidance: Public water systems are responsible to adequately design and maintain their systems in order to deliver an adequate quantity of clean, safe drinking water to their customers while maintaining a minimum pressure of 20 psi at all times, including peak demands (see R309-102-11 and R309-550-5).***

***Public water systems are being required to develop and operate a program to protect their systems from backflow or backsiphonage. An individual home booster pump, if installed such that the suction side of the pump draws directly from the system's water main rather than through an intermediate holding tank, may reduce the pressure in the main to less than 20 psi (perhaps even creating a vacuum), thereby increasing the potential for contaminated water to enter the distribution system through any minor undetected leaks that may exist.***

***We cannot regulate the individual homeowner, but we do not want to encourage where there is no other acceptable alternative, but each public water system should review language included in their service agreements with customers and perhaps modify such as needed.***

### (4) Service Lines.

The portion of the service line under the control of the water supplier is considered to be part of the distribution system and shall comply with all requirements given herein.

### (5) Service Meters and Building Service Line.

Connections between the service meter and the home shall be in accordance with the Utah Plumbing Code.

***Guidance: Each service connection should be individually metered.***

### (6) Allowable Connections.

All dwellings or other facilities connected to a public water supply shall be in conformance with the Utah Plumbing Code.

## *R309-550-12. Transmission Lines.*

### (1) Unpressurized Flows.

Transmission lines shall conform to all applicable requirements in this rule. Transmission line design shall minimize unpressurized flows.

***Guidance: Unpressurized flow makes the transmission line more vulnerable to contamination from surface water or shallow ground water.***

### (2) Proximity to Concentrated Sources of Pollution.

A water supplier shall not route an unpressurized transmission line any closer than fifty feet to any concentrated source of pollution (i.e. septic tanks and drain fields, garbage dumps, pit privies, sewer lines, feed lots, etc.). Furthermore, unpressurized transmission lines shall not be placed in boggy areas or areas subject to the ponding of water.

### (3) Exceptions.

Where the water supplier cannot obtain a fifty foot separation distance from concentrated sources of pollution, it is permitted to use a Class 50 ductile iron pipe with joints acceptable to the Executive Secretary. Reasonable assurance must be provided to assure that contamination will not be able to enter the unpressurized pipeline.

***Guidance: To assure continued protection of the transmission line, the water supplier should obtain a fifty foot right-of-way on each side of the transmission line.***

***Guidance: Water supply conduits and major service lines crossing known fault areas should be either designed to accommodate significant differential movement of the ground or be valued immediately above and below the points of fault crossing to allow control of water flow in case of pipe rupture during an earthquake event.***

***Guidance: Water supply systems which receive their supply from more than one source should be designed to provide alternative flow paths for major conduits in regions of known faults or, if such is not possible, that parallel routing of major conduits be avoided.***

## *R309-550-13. Operation and Maintenance.*

### (1) Disinfection After Line Repair.

The disinfection procedures of Section 4.7, AWWA Standard C651-99 shall be followed if any water main is cut into or repaired.

## (2) Cross Connections.

The water supplier shall not allow a connection which may jeopardize water quality. Cross connections are not allowed unless controlled by an approved and properly operating backflow prevention assembly. The requirements of the Utah Plumbing Code shall be met with respect to cross connection control and backflow prevention.

Suppliers shall maintain an inventory of each pressure vacuum breaker assembly, spill-resistant vacuum breaker assembly, double check valve assembly, reduced pressure principle backflow prevention assembly, and high hazard air gap used by their customers, and a service/inspection record for each such assembly.

Backflow prevention assemblies shall be inspected and tested at least once a year, by an individual certified for such work. This responsibility may be borne by the water system or the water system management may require that the customer having the backflow prevention assembly be responsible for having the device tested.

Suppliers serving areas also served by a pressurized irrigation system shall prevent cross connections between the two. Requirements for pressurized irrigation systems are outlined in Section 19-4-112 of the Utah Code.

## (3) NSF Standards.

All pipe and fittings used in routine operation and maintenance shall be ANSI-certified as meeting NSF Standard 61 or Standard 14.

## (4) Seasonal Operation.

Water systems operated seasonally shall be disinfected and flushed according to the techniques given in AWWA Standard C651-99 for pipelines and AWWA Standard C652-92 for storage facilities prior to each season's use. A satisfactory bacteriologic sample shall be achieved prior to use. During the non-use period, care shall be taken to close all openings into the system.

***Guidance: Emergencies***

***Water systems in areas subject to high earthquake hazard are encouraged to develop contingency plans for obtaining pipe and appurtenances in an emergency. The stockpiling of material should be considered.***

***Guidance: Operation and Maintenance Procedures Requiring Plan Approval.***

***Refer to Subsection R309-500-5 to determine under what circumstances a pipeline repair or replacement procedure shall be pre-approved by the Division.***

**KEY: drinking water, transmission and distribution pipelines, connections, water hauling**
August 15, 2001 19-4-104

# R309-600 Drinking Water Source Protection for Ground-Water Sources (Effective June 12, 2000)

**Original Adoption July 26, 1993**
**Revised July 26, 1995**
**Revised June 15, 1998**
**Revised January 15, 1999**
**Revised June 12, 2000**

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# R309-600 Drinking Water Source Protection For Ground-Water Sources

## *R309-600-1. Authority.*

Under authority of Section 19-4-104(1)(a)(iv), the Drinking Water Board adopts this rule which governs the protection of ground-water sources of drinking water.

## *R309-600-2. Purpose.*

Public Water Systems (PWSs) are responsible for protecting their sources of drinking water from contamination. R309-600 sets forth minimum requirements to establish a uniform, statewide program for implementation by PWSs to protect their ground-water sources of drinking water. PWSs are encouraged to enact more stringent programs to protect their sources of drinking water if they decide they are necessary.

R309-600 applies to ground-water sources and to ground-water sources which are under the direct influence of surface water which are used by PWSs to supply their systems with drinking water. However, compliance with this rule is voluntary for existing ground-water sources of drinking water which are used by public (transient) non-community water systems.

## *R309-600-3. Implementation.*

(1) New Ground-Water Sources - Each PWS shall submit a Preliminary Evaluation Report (PER) in accordance with R309-600-13(2) for each of its new ground-water sources to the Division of Drinking Water (DDW). A PWS shall not begin construction of a new source until DDW concurs with its PER.

(2) Existing Ground-Water Sources - Each PWS shall submit a Drinking Water Source Protection (DWSP) Plan in accordance with R309-600-7(1) for each of its existing ground-water sources to DDW according to the following schedule. Well fields or groups of springs may be considered to be a single source.

**Table 1**

| Population Served by PWS | Percent of Sources | DWSP Plans Due by |
|---|---|---|
| Over 10,000 | 50% of Wells | December 31, 1995 |
| Over 10,000 | 100% of Wells | December 31, 1996 |
| 3,300 – 10,000 | 100% of Wells | December 31, 1997 |

| | | |
|---|---|---|
| Less than 3,300 | 100% of Wells | December 31, 1998 |
| Springs and other sources | 100% | December 31, 1999 |

(3) DWSP for existing ground-water sources under the direct influence of surface water shall be accomplished through delineation of both the ground water and surface water contribution areas. The requirements of R309-600-7(1) apply to the ground water portion and the requirements of R309-605 apply to the surface water portion, except that the schedule for submitting these DWSP plans to DDW is based on the schedule in R309-605-3(1).

(4) PWSs shall maintain all land use agreements which were established under previous rules to protect their ground-water sources of drinking water from contamination. Additionally, PWSs shall maintain land ownership and land-use agreements established under previous rules with new owners which prohibit these new owners from locating pollution sources within protection zones.

## *R309-600-4. Exceptions.*

(1) Exceptions to the requirements of R309-600 or parts thereof may be granted by the Executive Secretary to PWSs if: due to compelling factors (which may include economic factors), a PWS is unable to comply with these requirements, and the granting of an exception will not result in an unreasonable risk to health.

(2) The Executive Secretary may prescribe a schedule by which the PWS must come into compliance with the requirements of R309-600.

## *R309-600-5. Designated Person.*

(1) A designated person shall be appointed and reported in writing to the Executive Secretary by each PWS within 180 days of the effective date of R309-600. The designated person's address and telephone number shall be included in the written correspondence. Additionally, the above information must be included in each DWSP Plan and PER that is submitted to DDW.

(2) Each PWS shall notify the Executive Secretary in writing within 30 days of any changes in the appointment of a designated person.

## *R309-600-6. Definitions.*

(1) The following terms are defined for the purposes of this rule:

(a) "Collection area" means the area surrounding a ground-water source which is underlain by collection pipes, tile, tunnels, infiltration boxes, or other ground-water collection devices.

(b) "Controls" means the codes, ordinances, rules, and regulations currently in effect to regulate a potential contamination source. "Controls" also means physical controls which may prevent contaminants from migrating off of a site and into surface or ground water. "Controls" also means negligible quantities of contaminants.

(c) "Criteria" means the conceptual standards that form the basis for DWSP area delineation to include distance, ground-water time of travel, aquifer boundaries, and ground-water divides.

(d) "Criteria threshold" means a value or set of values selected to represent the limits above or below which a given criterion will cease to provide the desired degree of protection.

(e) "DDW" means Division of Drinking Water.

(f) "DWSP Program" means the program to protect drinking water source protection zones and management areas from contaminants that may have an adverse effect on the health of persons.

(g) "DWSP Zone" means the surface and subsurface area surrounding a ground-water source of drinking water supplying a PWS, through which contaminants are reasonably likely to move toward and reach such ground-water source.

(h) "Designated person" means the person appointed by a PWS to ensure that the requirements of R309-600 are met.

(i) "Executive Secretary" means the individual authorized by the Drinking Water Board to conduct business on its behalf.

(j) "Existing ground-water source of drinking water" means a public supply ground-water source for which plans and specifications were submitted to DDW on or before July 26, 1993.

(k) "Ground-water Source" means any well, spring, tunnel, adit, or other underground opening from or through which ground-water flows or is pumped from subsurface water-bearing formations.

(l) "Hydrogeologic methods" means the techniques used to translate selected criteria and criteria thresholds into mappable delineation boundaries. These methods include, but are not limited to, arbitrary fixed radii, analytical calculations and models, hydrogeologic mapping, and numerical flow models.

(m) "Land management strategies" means zoning and non-zoning strategies which include, but are not limited to, the following: zoning and subdivision ordinances, site plan reviews, design and operating standards, source prohibitions, purchase of property and development rights, public education programs, ground-water monitoring, household hazardous waste collection programs, water conservation programs, memoranda of understanding, written contracts and agreements, and so forth.

(n) "Land use agreement" means a written agreement wherein the owner(s) agrees not to locate or allow the location of uncontrolled potential contamination sources or pollution sources within zone one of new wells in protected aquifers. The owner(s) must also agree not to locate or allow the location of pollution sources within zone two of new wells in unprotected aquifers and new springs unless the pollution source agrees to install design standards which prevent contaminated discharges to ground water. This restriction must be binding on all heirs, successors, and assigns. Land use agreements must be recorded with the property description in the local county recorder's office. Refer to R309-600-13(2)(d).

Land use agreements for protection areas on publicly owned lands need not be recorded in the local county recorder office. However, a letter must be obtained from the Administrator of the land in question and meet the requirements described above.

(o) "Management area" means the area outside of zone one and within a two-mile radius where the Optional Two-mile Radius Delineation Procedure has been used to identify a protection area.

For wells, land may be excluded from the DWSP management area at locations where it is more than 100 feet lower in elevation than the total drilled depth of the well.

For springs and tunnels, the DWSP management area is all land at elevation equal to or higher than, and within a two-mile radius, of the spring or tunnel collection area. The DWSP management area also includes all land lower in elevation than, and within 100 horizontal feet, of the spring or tunnel collection area. The elevation datum to be used is the point of water collection. Land may also be excluded from the DWSP management area at locations where it is separated from the ground-water source by a surface drainage which is lower in elevation than the spring or tunnel collection area.

(p) "New ground-water source of drinking water" means a public supply ground-water source of drinking water for which plans and specifications are submitted to DDW after July 26, 1993.

(q) "Nonpoint source" means any diffuse source of pollutants or contaminants not otherwise defined as a point source.

(r) "PWS" means public water system.

(s) "Point source" means any discernible, confined, and discrete source of pollutants or contaminants, including but not limited to any site, pipe, ditch, channel, tunnel, conduit, well, discrete fissure, container, rolling stock, animal feeding operation with more than ten animal units, landfill, or vessel or other floating craft, from which pollutants are or may be discharged.

(t) "Pollution source" means point source discharges of contaminants to ground water or potential discharges of the liquid forms of "extremely hazardous substances" which are stored in containers in excess of "applicable threshold planning quantities" as specified in SARA Title III. Examples of possible pollution sources include, but are not limited to, the following: storage facilities that store the liquid forms of extremely hazardous substances, septic tanks, drain fields, class V underground injection wells, landfills, open dumps, landfilling of sludge and septage, manure piles, salt piles, pit privies, drain lines, and animal feeding operations with more than ten animal units.

The following definitions are part of R309-600 and clarify the meaning of “pollution source”:

(i) "Animal feeding operation" means a lot or facility where the following conditions are met: animals have been or will be stabled or confined and fed or maintained for a total of 45 days or more in any 12 month period, and crops, vegetation forage growth, or post-harvest residues are not sustained in the normal growing season over any portion of the lot or facility. Two or more animal feeding operations under common ownership are considered to be a single feeding operation if they adjoin each other, if they use a common area, or if they use a common system for the disposal of wastes.

(ii) "Animal unit" means a unit of measurement for any animal feeding operation calculated by adding the following numbers; the number of slaughter and feeder cattle multiplied by 1.0, plus the number of mature dairy cattle multiplied by 1.4, plus the number of swine weighing over 55 pounds multiplied by 0.4, plus the number of sheep multiplied by 0.1, plus the number of horses multiplied by 2.0.

(iii) "Extremely hazardous substances" means those substances which are identified in the Sec. 302(EHS) column of the "Title III List of Lists: Consolidated List of Chemicals Subject to the Emergency Planning and Community Right-to-Know Act (EPCRA) and Section 112(R) of the Clean Air Act, As Amended," (550B98017). A copy of this document may be obtained from: NCEPI, PO Box 42419, Cincinnati, OH 45202. Online ordering is also available at http://www.epa.gov/ncepihom/orderpub.html.

(u) "Potential contamination source" means any facility or site which employs an activity or procedure which may potentially contaminate ground water. A pollution source is also a potential contamination source.

(v) "Protected aquifer" means a producing aquifer in which the following conditions are met:

(i) A naturally protective layer of clay, at least 30 feet in thickness, is present above the aquifer;

(ii) the PWS provides data to indicate the lateral continuity of the clay layer to the extent of zone two; and

(iii) the public-supply well is grouted with a grout seal that extends from the ground surface down to at least 100 feet below the surface, and for a thickness of at least 30 feet through the protective clay layer.

(w) "Replacement well" means a public-supply well drilled for the sole purpose of replacing an existing public-supply well which is impaired or made useless by structural difficulties and in which the following conditions are met:

(i) the proposed well location shall be within a radius of 150 feet from an existing ground-water supply well, as defined in R309-600-6(1)(j); and

(ii) the PWS provides a copy of the replacement application approved by the State Engineer (refer to Section 73-3-28 of the Utah Code Annotated).

(x) "Time of travel" means the time required for a particle of water to move in the producing aquifer from a specific point to a ground-water source of drinking water.

(y) "Unprotected aquifer" means any aquifer that does not meet the definition of a protected aquifer.

(z) "Wellhead" means the physical structure, facility, or device at the land surface from or through which ground-water flows or is pumped from subsurface, water-bearing formations.

## *R309-600-7. DWSP Plans.*

(1) Each PWS shall develop, submit, and implement a DWSP Plan for each of its ground-water sources of drinking water.

Required Sections for DWSP Plans - DWSP Plans should be developed in accordance with the "Standard Report Format for Existing Wells and Springs." This document may be obtained from DDW. DWSP Plans must include the following seven sections:

(a) DWSP Delineation Report - A DWSP Delineation Report in accordance with R309-600-9(5) is the first section of a DWSP Plan.

(b) Potential Contamination Source Inventory and Assessment of Controls - A Prioritized Inventory of Potential Contamination Sources and an assessment of their controls in accordance with R309-600-10 is the second section of a DWSP Plan.

(c) Management Program to Control Each Preexisting Potential Contamination Source - A Management Program to Control Each Preexisting Potential Contamination Source in accordance with R309-600-11 is the third section of a DWSP Plan.

(d) Management Program to Control or Prohibit Future Potential Contamination Sources - A Plan for Controlling or Prohibiting Future Potential Contamination Sources is the fourth section of a DWSP Plan. This must be in accordance with R309-600-12, consistent with the general provisions of this rule, and implemented to an extent allowed under the PWS's authority and jurisdiction.

(e) Implementation Schedule - Each PWS shall develop a step-by-step implementation schedule which lists each of its proposed land management strategies with an implementation date for each strategy.

(f) Resource Evaluation - Each PWS shall assess the financial and other resources which may be required for it to implement each of its DWSP Plans and determine how these resources may be acquired.

(g) Recordkeeping - Each PWS shall document changes in each of its DWSP Plans as they are continuously updated to show current conditions in the protection zones and management areas. As a DWSP Plan is executed, the PWS shall document any land management strategies that are implemented. These documents may include any of the following: ordinances, codes, permits, memoranda of understanding, public education programs, public notifications, and so forth.

(2) DWSP Plan Administration - DWSP Plans shall be submitted, corrected, retained, implemented, updated, and revised according to the following:

(a) Submitting DWSP Plans - Each PWS shall submit a DWSP Plan to DDW in accordance with the schedule in R309-600-3 for each of its ground-water sources of drinking water.

(b) Correcting Deficiencies - Each PWS shall correct any deficiencies in a disapproved DWSP Plan and resubmit it to DDW within 90 days of the disapproval date.

(c) Retaining DWSP Plans - Each PWS shall retain on its premises a current copy of each of its DWSP Plans.

(d) Implementing DWSP Plans - Each PWS shall begin implementing each of its DWSP Plans in accordance with its schedule in R309-600-7(1)(e), within 180 days after submittal if they are not disapproved by DDW.

(e) Updating and Resubmitting DWSP Plans - Each PWS shall update its DWSP Plans as often as necessary to ensure they show current conditions in the DWSP zones and management areas. Updated plans also document the implementation of land management strategies in the recordkeeping section. DWSP Plans are initially due according to the schedule in R309-600-3. Thereafter, updated DWSP Plans are due every six years from their original due date. This applies even though a PWS may have been granted an extension beyond the original due date.

(f) Revising DWSP Plans - Each PWS shall submit a revised DWSP Plan to DDW within 180 days after the reconstruction or redevelopment of any ground-water source of drinking water which addresses changes in source construction, source development, hydrogeology, delineation, potential contamination sources, and proposed land management strategies.

## *R309-600-8. DWSP Plan Review.*

(1) DDW shall review each DWSP Plan submitted by PWSs and "concur," "concur with recommendations," "conditionally concur" or "disapprove" the plan.

(2) DDW may "disapprove" DWSP Plans for any of the following reasons:

(a) An inaccurate DWSP Delineation Report, a report that uses a non-applicable delineation method, or a DWSP Plan that is missing this report or any of the information and data required in it (refer to R309-600-9(5));

(b) an inaccurate Prioritized Inventory of Potential Contamination Sources or a DWSP Plan that is missing this report or any of the information required in it (refer to R309-600-10(1));

(c) an inaccurate assessment of current controls (refer to R309-600-10(2));

(d) a missing Management Program to Control Each Preexisting Potential Contamination Source which has been assessed as "not adequately controlled" by the PWS (refer to R309-600-11(1));

(e) a missing Management Program to Control or Prohibit Future Potential Contamination Sources (refer to R309-600-12);

(f) a missing or incomplete Implementation Schedule, Resource Evaluation, Recordkeeping Section, Contingency Plan, or Public Notification Plan (refer to R309-600-7(1)(e)-(g), R309-600-14, and R309-600-15).

(3) DDW may "concur with recommendations" when PWSs propose management programs to control preexisting potential contamination sources or management programs to control or prohibit future potential contamination sources for existing or new drinking water sources which appear inadequate or ineffective.

(4) DDW may "conditionally concur" with a DWSP Plan or PER. The PWS must implement the conditions and report compliance the next time the DWSP Plan is due and submitted to DDW.

## *R309-600-9. Delineation of Protection Zones and Management Areas.*

(1) PWSs shall delineate protection zones or a management area around each of their ground-water sources of drinking water using the Preferred Delineation Procedure or the Optional Two-mile Radius Delineation Procedure. The hydrogeologic method used by PWSs shall produce protection zones or a management area in accordance with the criteria thresholds below. PWSs may also choose to verify protected aquifer conditions to reduce the level of management controls applied in applicable protection areas.

(2) Criteria Thresholds for Ground-water Sources of Drinking Water:

(a) Preferred Delineation Procedure - Four zones are delineated for management purposes:

(i) Zone one is the area within a 100-foot radius from the wellhead or margin of the collection area.

(ii) Zone two is the area within a 250-day ground-water time of travel to the wellhead or margin of the collection area, the boundary of the aquifer(s) which supplies water to the ground-water source, or the ground-water divide, whichever is closer. If the available data indicate a zone of increased ground-water velocity within the producing aquifer(s), then time-of-travel calculations shall be based on this data.

(iii) Zone three (waiver criteria zone) is the area within a 3-year ground-water time of travel to the wellhead or margin of the collection area, the boundary of the aquifer(s) which supplies water to the ground-water source, or the ground-water divide, whichever is closer. If the available data indicate a zone of increased ground-water velocity within the producing aquifer(s), then time-of-travel calculations shall be based on this data.

(iv) Zone four is the area within a 15-year ground-water time of travel to the wellhead or margin of the collection area, the boundary of the aquifer(s) which supplies water to the ground-water source, or the ground-water divide, whichever is closer. If the available data indicate a zone of increased ground-water velocity within the producing aquifer(s), then time-of-travel calculation shall be based on this data.

(b) Optional Two-mile Radius Delineation Procedure - In place of the Preferred Delineation Procedure, PWSs may choose to use the Optional Two-mile Radius Delineation Procedure to delineate a management area. This procedure is best applied in remote areas where few if any potential contamination sources are located. Refer to R309-600-6(1)(o) for the definition of a management area.

(3) Protected Aquifer Classification - PWSs may choose to verify protected aquifer conditions to reduce the level of management controls for a public-supply well which produces water from a protected aquifer(s) or to meet one of the requirements of a VOC or pesticide susceptibility waiver (R309-600-16(4)). Refer to R309-600-6(1)(v) for the definition of a "protected aquifer."

(4) Special Conditions - Special scientific or engineering studies may be conducted to support a request for an exception (refer to R309-600-4) due to special conditions. These studies must be approved by DDW before the PWS begins the study. Special studies may include confined aquifer conditions, ground-water movement through protective layers, wastewater transport and fate, etc.

(5) DWSP Delineation Report - Each PWS shall submit a DWSP Delineation Report to DDW for each of its ground-water sources using the Preferred Delineation Procedure or the Optional Two-mile Radius Delineation Procedure.

(a) Preferred Delineation Procedure - Delineation reports for protection zones delineated using the Preferred Delineation Procedure shall include the following information and a list of all sources or references for this information:

(i) Geologic Data - A brief description of geologic features and aquifer characteristics observed in the well and area of the potential protection zones. This should include the formal or informal stratigraphic name(s), lithology of the aquifer(s) and confining unit(s), and description of fractures and solution cavities (size, abundance, spacing, orientation) and faults (brief description of location in or near the well, and orientation). Lithologic descriptions can be obtained from surface hand samples or well cuttings; core samples and laboratory analyses are not necessary. Fractures, solution cavities, and faults may be described from surface outcrops or drill logs.

(ii) Well Construction Data - If the source is a well, the report shall include the well drillers log, elevation of the wellhead, borehole radius, casing radius, total depth of the well, depth and length of the screened or perforated interval(s), well screen or perforation type, casing type, method of well construction, type of pump, location of pump in the well, and the maximum projected pumping rate of the well. The maximum pumping rate of the well must be used in the delineation calculations. Averaged pumping rate values shall not be used.

(iii) Spring Construction Data - If the source is a spring or tunnel the report shall include a description or diagram of the collection area and method of ground-water collection.

(iv) Aquifer Data for New Wells - A summary report including the calculated hydraulic conductivity of the aquifer, transmissivity, hydraulic gradient, direction of ground-water flow, estimated effective porosity, and saturated thickness of the producing aquifer(s). The PWS shall obtain the hydraulic conductivity of the aquifer from a constant-rate aquifer test and provide the data as described in R309-204-6(10)(b). Estimated effective porosity must be between 1% and 30%. Clay layers shall not be included in calculations of aquifer thickness or estimated effective porosity. This report shall include graphs, data, or printouts showing the interpretation of the aquifer test

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(v) Aquifer Data for Existing Wells - A summary report including the calculated hydraulic conductivity of the aquifer, transmissivity, hydraulic gradient, direction of ground-water flow, estimated effective porosity, and saturated thickness of the producing aquifer(s). The PWS shall obtain the hydraulic conductivity of the aquifer from a constant-rate aquifer test using the existing pumping equipment. Aquifer tests using observation wells are encouraged, but are not required. If a previously performed aquifer test is available and includes the required data described below, data from that test may be used instead. Estimated effective porosity must be between 1% and 30%. Clay layers shall not be included in calculations of aquifer thickness or estimated effective porosity. This report shall include graphs, data, or printouts showing the interpretation of the aquifer test.

If a constant-rate aquifer test is not practical, then the PWS shall obtain hydraulic conductivity of the aquifer using another appropriate method, such as data from a nearby well in the same aquifer, specific capacity of the well, published hydrogeologic studies of the same aquifer, or local or regional ground-water models. A constant-rate test may not be practical for such reasons as insufficient drawdown in the well, inaccessibility of the well for water-level measurements, or insufficient overflow capacity for the pumped water.

The constant-rate test shall:

(A) Provide for continuous pumping for at least 24 hours or until stabilized drawdown has continued for at least six hours. Stabilized drawdown is achieved when there is less than one foot of change of ground-water level in the well within a six-hour period.

(B) Provide data as described in R309-204-6(10)(b)(v) through (vii).

(vi) Additional Data for Observation Wells - If the aquifer test is conducted using observation wells, the report shall include the following information for each observation well: location and surface elevation; total depth; depth and length of the screened or perforated intervals; radius, casing type, screen or perforation type, and method of construction; prepumping ground-water level; the time-drawdown or distance-drawdown data and curve; and the total drawdown.

(vii) Hydrogeologic Methods and Calculations - These include the ground-water model or other hydrogeologic method used to delineate the protection zones, all applicable equations, values, and the calculations which determine the delineated boundaries of zones two, three, and four. The hydrogeologic method or ground-water model must be reasonably applicable for the aquifer setting. For wells, the hydrogeologic method or ground-water model must include the effects of drawdown (increased hydraulic gradient near the well) and interference from other wells.

(viii) Map Showing Boundaries of the DWSP Zones - A map showing the location of the ground-water source of drinking water and the boundary for each DWSP zone. The base map shall be a 1:24,000-scale (7.5-minute series) topographic map, such as is published by the U.S. Geological Survey. Although zone one (100-foot radius around the well or margin of the collection area) need not be on the map, the complete boundaries for zones two, three, and four must be drawn and labeled. More detailed maps are optional and may be submitted in addition to the map required above

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The PWS shall also include a written description of the distances which define the delineated boundaries of zones two, three, and four. These written descriptions must include the maximum distances upgradient from the well, the maximum distances downgradient from the well, and the maximum widths of each protection zone.

(b) Optional Two-Mile Radius Delineation Procedure - Delineation Reports for protection areas delineated using the Optional Two-mile Radius Delineation Procedure shall include the following information:

(i) Map Showing Boundaries of the DWSP Management Area - A map showing the location of the ground-water source of drinking water and the DWSP management area boundary. The base map shall be a 1:24,000-scale (7.5-minute series) topographic map, such as is published by the U.S. Geological Survey. Although zone one (100-foot radius around the well or margin of the collection area) need not be on the map, the complete two-mile radius must be drawn and labeled. More detailed maps are optional and may be submitted in addition to the map required above.

(ii) Hydrogeologic Report to Exclude a Potential Contamination Source - To exclude a potential contamination source from the inventory which is required in R309-600-10(1), a hydrogeologic report is required which clearly demonstrates that the potential contamination source has no capacity to contaminate the source.

(6) Protected Aquifer Conditions - If a PWS chooses to verify protected aquifer conditions, it shall submit the following additional data to DDW for each of its ground-water sources for which the protected aquifer conditions apply. The report must state that the aquifer meets the definition of a protected aquifer based on the following information:

(a) thickness, depth, and lithology of the protective clay layer;

(b) data to indicate the lateral continuity of the protective clay layer over the extent of zone two. This may include such data as correlation of beds in multiple wells, published hydrogeologic studies, stratigraphic studies, potentiometric surface studies, and so forth; and

(c) evidence that the well has been grouted or otherwise sealed from the ground surface to a depth of at least 100 feet and for a thickness of at least 30 feet through the protective clay layer in accordance with R309-600-6(1)(v) R309-204-6(6)(i).

## *R309-600-10. Potential Contamination Source Inventory and Identification and Assessment of Controls.*

(1) Prioritized Inventory of Potential Contamination Sources - Each PWS shall list all potential contamination sources within each DWSP zone or management area in priority order and state the basis for this order. This priority ranking shall be according to relative risk to the drinking water source. The name and address of each commercial and industrial potential contamination source is required. Additional information should include the name and phone number of a contact person and a list of the chemical, biological, and/or radiological hazards associated with each potential contamination source. Additionally, each PWS shall identify each potential contamination source as to

its location in zone one, two, three, four or in a management area and plot it on the map required in R309-600-9(5)(a)(viii) or R309-600-9(5)(b)(i).

(a) List of Potential Contamination Sources - A List of Potential Contamination Sources is found in the "Source Protection User's Guide for Ground-Water Sources." This document may be obtained from DDW. This list may be used by PWSs as a guide to inventorying potential contamination sources within their DWSP zones and management areas.

(b) Refining, Expanding, Updating, and Verifying Potential Contamination Sources - Each PWS shall update its list of potential contamination sources to show current conditions within DWSP zones or management areas. This includes adding potential contamination sources which have moved into DWSP zones or management areas, deleting potential contamination sources which have moved out, improving available data about potential contamination sources, and all other appropriate refinements.

(2) Identification and Assessment of Current Controls - PWSs are not required to plan and implement land management strategies for potential contamination source hazards that are assessed as "adequately controlled." If controls are not identified, the potential contamination source will be considered to be "not adequately controlled." Additionally, if the hazards at a potential contamination source cannot be identified, the potential contamination source must be assessed as "not adequately controlled." Identification and assessment should be limited to one of the following controls for each applicable hazard: regulatory, best management/pollution prevention, physical, or negligible quantity. Each of the following topics for a control must be addressed before identification and assessment will be considered to be complete. Refer to the "Source Protection User's Guide for Ground-Water Sources" for a list of government agencies and the programs they administer to control potential contamination sources. This guide may be obtained from DDW.

(a) Regulatory Controls - Identify the enforcement agency and verify that the hazard is being regulated by them; cite and/or quote applicable references in the regulation, rule or ordinance which pertain to controlling the hazard; explain how the regulatory control prevents ground-water contamination; assess the hazard; and set a date to reassess the hazard.

(b) Best Management/Pollution Prevention Practice Controls - List the specific best management/pollution prevention practices which have been implemented by potential contamination source management to control the hazard and indicate that they are willing to continue the use of these practices; explain how these practices prevent ground-water contamination; assess the hazard; and set a date to reassess the hazard.

(c) Physical Controls - Describe the physical control(s) which have been constructed to control the hazard; explain how these controls prevent contamination; assess the hazard; and set a date to reassess the hazard.

(d) Negligible Quantity Control - Identify the quantity of the hazard that is being used, disposed, stored, manufactured, and/or transported; explain why this amount should be considered a negligible quantity; assess the hazard; and set a date to reassess the hazard.

(3) For the purpose of meeting the requirements of R309-600, DDW will consider a PWS's assessment that a potential contamination source which is covered by a permit or approval under one of the regulatory programs listed below sufficient to demonstrate that the source is adequately controlled unless otherwise determined by the Executive Secretary. For all other state programs, the PWS's assessment is subject to review by DDW; as a result, a PWS's DWSP Plan may be disapproved if DDW does not concur with its assessment(s).

(a) The Utah Ground-Water Quality Protection program established by Section 19-5-104 and R317-6;

(b) closure plans or Part B permits under authority of the Resource Conservation and Recovery Act (RCRA) of 1984 regarding the monitoring and treatment of ground water;

(c) the Utah Pollutant Discharge Elimination System (UPDES) established by Section 19-5-104 and R317-8;

(d) the Underground Storage Tank Program established by Section 19-6-403 and R311-200 through R311-208; and

(e) the Underground Injection Control (UIC) Program for classes I-IV established by Sections 19-5-104 and 40-6-5 and R317-7 and R649-5.

## *R309-600-11. Management Program to Control Each Preexisting Potential Contamination Source.*

(1) PWSs shall plan land management strategies to control each preexisting potential contamination source in accordance with their authority and jurisdiction. Land management strategies must be consistent with the provisions of R309-600, designed to control potential contamination, and may be regulatory or non-regulatory. Each potential contamination source listed on the inventory required in R309-600-10(1) and assessed as "not adequately controlled" must be addressed. Land management strategies must be implemented according to the schedule required in R309-600-7(1)(e).

(2) PWSs with overlapping protection zones and management areas may cooperate in controlling a particular preexisting potential contamination source if one PWS will agree to take the lead in planning and implementing land management strategies and the remaining PWS(s) will assess the preexisting potential contamination source as "adequately controlled."

## *R309-600-12. Management Program to Control or Prohibit Future Potential Contamination Sources for Existing Drinking Water Sources.*

(1) PWSs shall plan land management strategies to control or prohibit future potential contamination sources within each of its DWSP zones or management areas consistent with the provisions of R309-600 and to an extent allowed under its authority and jurisdiction. Land management strategies must be designed to control potential contamination and may be regulatory or non-regulatory. Additionally land management strategies must be implemented according to the schedule required in R309-600-7(1)(e).

(2) Protection areas may extend into neighboring cities, towns, and counties. Since it may not be possible for some PWSs to enact regulatory land management strategies outside of their jurisdiction, except as described below, it is recommended that these PWSs contact their neighboring cities, towns, and counties to see if they are willing to implement protective ordinances to prevent ground-water contamination under joint management agreements.

(3) Cities and towns have extraterritorial jurisdiction in accordance with Section 10-8-15 of the Utah Code Annotated to enact ordinances to protect a stream or "source" from which their water is taken... "for 15 miles above the point from which it is taken and for a distance of 300 feet on each side of such stream..." Section 10-8-15 includes ground-water sources.

(4) Zoning ordinances are an effective means to control potential contamination sources that may want to move into protection areas. They allow PWSs to prohibit facilities that would discharge contaminants directly to ground water. They also allow PWSs to review plans from potential contamination sources to ensure there will be adequate spill protection and waste disposal procedures, etc. If zoning ordinances are not used, PWSs must establish a plan to contact potential contamination sources individually as they move into protection areas, identify and assess their controls, and plan land management strategies if they are not adequately controlled.

## *R309-600-13. New Ground-water Sources of Drinking Water.*

(1) Prior to constructing a new ground-water source of drinking water, each PWS shall develop a PER which demonstrates whether the source meets the requirements of this section and submit it to DDW. Additionally, engineering information in accordance with R309-204-6(5)(a) or R309-204-7(4) must be submitted to DDW. DDW will not grant plan approval until both source protection and engineering requirements are met.

Construction standards relating to protection zones and management areas (fencing, diversion channels, sewer line construction, and grouting, etc.) are found in R309-204. After the source is constructed a DWSP Plan must be developed, submitted, and implemented accordingly.

(2) Preliminary Evaluation Report for New Sources of Drinking Water - PERs shall cover all four zones or the entire management area. PERs should be developed in accordance with the "Standard Report Format for New Wells and Springs." This document may be obtained from DDW. PWSs shall include the following four sections in each PER:

(a) Delineation Report for Estimated DWSP Zones - The same requirements apply as in R309-600-9(5), except that the hydrogeologic data for the PER must be developed using the best available data which may be obtained from: surrounding wells, published information, or surface geologic mapping. PWSs must use the Preferred Delineation Procedure to delineate protection zones for new wells.

(b) Inventory of Potential Contamination Sources and Identification and Assessment of Controls - The same requirements apply as in R309-600-10(1) and (2). Additionally, the PER must demonstrate that the source meets the following requirements:

(i) Protection Areas Delineated using the Preferred Delineation Procedure in Protected Aquifers - A PWS shall not locate a new ground-water source of drinking water where an uncontrolled potential contamination source or a pollution source exists within zone one.

(ii) Protection Areas Delineated using the Preferred Delineation Procedure in Unprotected Aquifers - A PWS shall not locate a new ground-water source of drinking water where an uncontrolled potential contamination source or an uncontrolled pollution source exists within zone one. Additionally, a new ground-water source of drinking water may not be located where a pollution source exists within zone two unless the pollution source implements design standards which prevent contaminated discharges to ground water.

(iii) Management Areas Delineated using the Optional Two-Mile Radius Delineation Procedure - A PWS shall not locate a new spring where an uncontrolled potential contamination source or a pollution source exists within zone one. Additionally, a new spring may not be located where a pollution source exist within the management area unless: a hydrogeologic report in accordance with R309-600-9(5)(b)(ii) which verifies that it does not impact the spring; or the pollution source implements design standards which prevent contaminated discharges to ground water.

(c) Land Ownership Map - A land ownership map which includes all land within zones one and two or the entire management area. Additionally, include a list which exclusively identifies the land owners in zones one and two or the management area, the parcel(s) of land which they own, and the zone in which they own land. A land ownership map and list are not required if ordinances are used to protect these areas.

(d) Land Use Agreements, Letters of Intent, or Zoning Ordinances - Land use agreements which meet the requirements of the definition in R309-600-6(1)(n). Zoning ordinances which are already in effect or letters of intent may be substituted for land use agreements; however, they must accomplish the same level of protection that is required in a land use agreement. Letters of intent must be notarized, include the same language that is required in land use agreements, and contain the statement that "the owner agrees to record the land use agreement in the county recorder's office, if the source proves to be an acceptable drinking water source." The PWS shall not introduce a new source into its system until copies of all applicable recorded land use agreements are submitted to DDW.

(3) Sewers Within DWSP Zones and Management Areas - Sewer lines may not be located within zones one and two or a management area unless the criteria identified below are met. If sewer lines are located or planned to be located within zones one and two or a management area, the PER must demonstrate that they comply with this criteria. Sewer lines that comply with this criteria may be assessed as adequately controlled potential contamination sources.

(a) Zone One - If the conditions specified in R309-600-13(3)(a)(i and ii) below are met, all sewer lines within zone one shall be constructed in accordance with R309-204-6(4) and must be at least 10 feet from the wellhead.

(i) There is at least 5 feet of suitable soil between the bottom of the sewer lines and the top of the maximum seasonal ground-water table or perched water table. (Suitable soils contain adequate sand/silt/clay to act as an effective effluent filter within its depth for the removal of pathogenic organisms and fill the voids between coarse particles such as gravel, cobbles, and angular rock fragments); and

(ii) there is at least 5 feet of suitable soil between the bottom of the sewer lines the top of any bedrock formations. (For the purposes of this rule, unsuitable soils or bedrock formations shall include soil or bedrock formations which have such low permeability that they prevent downward passage of effluent, or soil or bedrock formations with open joints or solution channels which permit such rapid flow that effluent is not renovated. This includes coarse particles such as gravel, cobbles, or angular rock fragments with insufficient soil to fill the voids between the

particles. Solid or fractured bedrock such as shale, sandstone, limestone, basalt, or granite are unacceptable.)

(b) Zones One and Two - If the conditions identified in R309-600-13(3)(a)(i and ii) above cannot be met, any sewer lines within zones one and two or a management area shall be constructed in accordance with R309-204-6(4) and must be at least 300 feet from the wellhead or margin of the collection area.

(4) Use waivers for the VOC and pesticide parameter groups may be issued if the inventory of potential contamination sources indicates that the chemicals within these parameter groups are not used, disposed, stored, transported, or manufactured within zones one, two, and three or the management area.

(5) Replacement Wells - A PER is not required for proposed wells, if the PWS receives written notification from DDW that the well is classified as a replacement well. The PWS must submit a letter requesting that the well be classified as a replacement well and include documentation to show that the conditions required in R309-600-6(1)(w) are met. If a proposed well is classified as a replacement well, the PWS is still required to submit and obtain written approval for all other information as required in:

(a) DWSP Plan for New Sources of Drinking Water (refer to R309-600-13(6), and

(b) the Outline of Well Approval Process (refer to R309-204-6(5)).

(6) DWSP Plan for New Sources of Drinking Water - The PWS shall submit a DWSP Plan in accordance with R309-600-7(1) for any new ground-water source of drinking water within one year after the date of DDW's concurrence letter for the PER. In developing this DWSP Plan, PWSs shall refine the information in the PER by applying any new, as-constructed characteristics of the source (i.e., pumping rate, aquifer test, etc.).

## *R309-600-14. Contingency Plans.*

PWSs shall submit a Contingency Plan which includes all sources of drinking water for their entire water system to DDW concurrently with the submission of their first DWSP Plan. Guidance for developing Contingency Plans may be found in the "Source Protection User's Guide for Ground-Water Sources." This document may be obtained from DDW.

## *R309-600-15. Public Notification.*

(1) Public Notification Plan - Each PWS shall append a Public Notification Plan to its next DWSP plan that is submitted to DDW in accordance with the schedules in R309-600-3(2), R309-600-3(3), R309-600-7(2)(e), and R309-600-13(6). This includes plans

that are submitted late or have been granted extensions. This Public Notification Appendix shall specify a schedule and method(s) to notify the PWS's customers and consumers of the general conclusions of their DWSP planning and shall generally address all of its ground-water sources of drinking water.

(2) Public Notifications - The first public notification shall be included in the Recordkeeping Section of the plan which is submitted in accordance with R309-600-15(1). This public notification must be released to the public within 30 days of the plan being submitted, whether or not the plan has been reviewed by DDW, or it must be contained in the PWS's next Consumer Confidence Report. Consumer Confidence Reports are released to the public annually by July 31st of the current year. All other public notifications shall be in accordance with the Public Notification Plan schedule and method(s) required in R309-600-15(1) and be included in the Recordkeeping Section of the designated plan. Public notifications shall address all of the PWS's ground-water sources and include a discussion of the following:

(a) The general geologic and physical setting of the sources;

(b) the general types of potential contamination sources within the protection zones;

(c) a susceptibility analysis that addresses the following:

(i) the geologic characteristics of the aquifer(s) (protected, unprotected, unknown),
(ii) the integrity of the grout seal of the well(s) or the impervious seal over the spring collection area(s),
(iii) a general assessment of the potential contamination sources as to whether they are controlled or uncontrolled, and
(iv) a summary statement of how susceptible the PWSs wells and springs are to contamination from the highest ranking potential contamination sources on their prioritized list; and

(d) a summary of the land management strategies that are being implemented to manage existing and future potential contamination source hazards.
Examples of means of notifying the public and examples of public notification material are discussed in the "Source Protection User's Guide for Ground-Water Sources" which may be obtained from DDW. Additionally, the public must be notified that complete DWSP plans are available to them upon request.

## *R309-600-16. Monitoring Reduction Waivers.*

(1) Three types of monitoring waivers are available to PWSs. They are: a) reliably and consistently, b) use, and c) susceptibility. The criteria for establishing a reliably and

consistently waiver is set forth in R309-104. The criteria for use and susceptibility waivers follows.

(2) If a source's DWSP plan is due according to the schedule in R309-600-3, and is not submitted to DDW, its use and susceptibility waivers for the VOC and pesticide parameter groups (refer to R309-104-4.3.1 e and f; and R309-104-4.3.2 h and i) will expire unless an exception (refer to R309-600-4) for a new due date has been granted. Additionally, current use and susceptibility waivers for the VOC, pesticide and unregulated parameter groups will expire upon review of a DWSP plan, if these waivers are not addressed in the plan.

(3) Use Waivers - If the chemicals within the VOC and/or pesticide parameter group(s) (refer to R309-103 table 103-3 and 103-2) have not been used, disposed, stored, transported, or manufactured within the past five years within zones one, two, and three, the source may be eligible for a use waiver. To qualify for a VOC and/or pesticide use waiver, a PWS must complete the following two steps:

(a) List the chemicals which are used, disposed, stored, transported, and manufactured at each potential contamination source within zones one, two, and three where the use of the chemicals within the VOC and pesticide parameter groups are likely; and

(b) submit a dated statement which is signed by the system's designated person that none of the VOCs and pesticides within these respective parameter groups have been used, disposed, stored, transported, or manufactured within the past five years within zones one, two, and three.

(4) Susceptibility Waivers - If a source does not qualify for use waivers, and if reliably and consistently waivers have not been issued, it may be eligible for susceptibility waivers. Susceptibility waivers tolerate the use, disposal, storage, transport, and manufacture of chemicals within zones one, two, and three as long as the PWS can demonstrate that the source is not susceptible to contamination from them. To qualify for a VOC and/or pesticide susceptibility waiver, a PWS must complete the following steps:

(a) Submit the monitoring results of at least one applicable sample from the VOC and/or pesticide parameter group(s) that has been taken within the past five years. A non-detectable analysis for each chemical within the parameter group(s) is required;

(b) submit a dated statement from the designated person verifying that the PWS is confident that a susceptibility waiver for the VOC and/or pesticide parameter group(s) will not threaten public health; and

(c) verify that the source is developed in a protected aquifer, as defined in R309-600-6(1)(v), and have a public education program which addresses proper

use and disposal practices for pesticides and VOCs which is described in the management sections of the DWSP plan.

(5) Special Waiver Conditions - Special scientific or engineering studies or best management practices may be developed to support a request for an exception to paragraph R309-600-16(4)(c) due to special conditions. These studies must be approved by DDW before the PWS begins the study. Special waiver condition studies may include:

(a) geology and construction/grout seal of the well to demonstrate geologic protection;

(b) memoranda of agreement which addresses best management practices for VOCs and/or pesticides with industrial, agricultural, and commercial facilities which use, store, transport, manufacture, or dispose of the chemicals within these parameter groups;

(c) public education programs which address best management practices for VOCs and/or pesticides;

(d) contaminant quantities;

(e) affected land area; and/or

(f) fate and transport studies of the VOCs and/or pesticides which are listed as hazards at the PCSs within zones one, two, and three, and any other conditions which may be identified by the PWS and approved by DDW.

**KEY: drinking water, environmental health**
**June 12, 2000 19-4-104(1)(a)(iv)**
**Notice of Continuation April 10, 1997**

# R309-605. Drinking Water Source Protection for Surface Water Sources (Effective August 27, 2001).

## Table of Contents

# R309-605. Source Protection: Drinking Water Source Protection for Surface Water Sources.

## *R309-605-1. Purpose.*

Public Water Systems (PWSs) are responsible for protecting their sources of drinking water from contamination. R309-605 sets forth minimum requirements to establish a uniform, statewide program for implementation by PWSs to protect their surface water sources of drinking water. PWSs are encouraged to enact more stringent programs to protect their sources of drinking water if they decide additional measures are necessary.

R309-605 applies to PWSs which obtain surface water prior to treatment and distribution and to PWSs obtaining water from ground-water sources which are under the direct influence of surface water. However, compliance with this rule is voluntary for public (transient) non-community water systems to the extent that they are using existing surface water sources of drinking water.

## *R309-605-2. Authority.*

Under authority of Subsection 19-4-104(1)(a)(iv), the Drinking Water Board adopts this rule which governs the protection of surface sources of drinking water.

## *R309-605-3. Definitions.*

(1) The following terms are defined for the purposes of this rule:

(a) "Controls" means the codes, ordinances, rules, and regulations that regulate a potential contamination source. "Controls" also means physical controls which may prevent contaminants from migrating off of a site and into surface or ground water. Controls also means negligible quantities of contaminants.

(b) "Division" means Division of Drinking Water.

(c) "DWSP Program" means the program and associated plans to protect drinking water sources from contaminants.

(d) "DWSP Zone" means the surface and subsurface area surrounding a surface source of drinking water supplying a PWS, over which or through which contaminants are reasonably likely to move toward and reach the source.

(e) "Designated person" means the person appointed by a PWS to ensure that the requirements of R309-605 are met.

(f) "Executive Secretary" means the individual appointed pursuant to Section 19-4-106 of the Utah Safe Drinking Water Act.

(g) "Existing surface water source of drinking water" means a public supply surface water source for which plans and specifications were submitted to DDW on or before June 12, 2000.

(h) "Intake", for the purposes of surface water drinking water source protection, means the device used to divert surface water and also the conveyance to the point immediately preceding treatment, or, if no treatment is provided, at the entry point to the distribution system.

(i) "Land management strategies" means zoning and non-zoning controls which include, but are not limited to, the following: zoning and subdivision ordinances, site plan reviews, design and operating standards, source prohibitions, purchase of property and development rights, public education programs, ground-water monitoring, household hazardous waste collection programs, water conservation programs, memoranda of understanding, and written contracts and agreements.
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(j) "New surface water source of drinking water" means a public supply surface water source of drinking water for which plans and specifications are submitted to the Executive Secretary after June 12, 2000.

(k) "Nonpoint source" means any area or conveyance not meeting the definition of point source.

(l) "Point of diversion" (POD) is the location at which water from a surface source enters a piped conveyance, storage tank, or is otherwise removed from open exposure prior to treatment.

(m) "Point source" means any discernible, confined, and discrete location or conveyance, including but not limited to any pipe, ditch, channel, tunnel, conduit, well, discrete fissure, container, rolling stock, animal feeding operation with more than ten animal units, landfill, or vessel or other floating craft, from which pollutants are or may be discharged. This term does not include return flows from irrigated agriculture.

(n) "Pollution source" means point source discharges of contaminants to surface water or potential discharges of the liquid forms of "extremely hazardous substances" which are stored in containers in excess of "applicable threshold planning quantities" as specified in the Emergency Planning and Community Right-to-Know Act(EPCRA),42 U.S.C. 11001 et seq. (1986). Examples of possible pollution sources include, but are not limited to, the following: storage facilities that store the liquid forms of extremely hazardous substances, septic tanks, drain fields, class V underground injection wells, landfills, open dumps, land filling of sludge and septage, manure piles, salt piles, pit privies, drain lines,

and animal feeding operations with more than ten animal units. The following definitions are part of R309-605 and clarify the meaning of "pollution source:"

(i) "Animal feeding operation" means a lot or facility where the following conditions are met: animals have been or will be stabled or confined and fed or maintained for a total of 45 days or more in any 12 month period, and crops, vegetation forage growth, or post-harvest residues are not sustained in the normal growing season over any portion of the lot or facility. Two or more animal feeding operations under common ownership are considered to be a single feeding operation if they adjoin each other, if they use a common area, or if they use a common system for the disposal of wastes.

(ii) "Animal unit" means a unit of measurement for any animal feeding operation calculated by adding the following numbers; the number of slaughter and feeder cattle multiplied by 1.0, plus the number of mature dairy cattle multiplied by 1.4, plus the number of swine weighing over 55 pounds multiplied by 0.4, plus the number of sheep multiplied by 0.1, plus the number of horses multiplied by 2.0.

(iii) "Extremely hazardous substances" means those substances which are identified in the Sec. 302(EHS) column of the "TITLE III LIST OF LISTS - Consolidated List of Chemicals Subject to Reporting Under SARA Title III," (EPA 550-B-96-015). A copy of this document may be obtained from: NCEPI, PO Box 42419, Cincinnati, OH 45202. Online ordering is also available at: http://www.epa.gov/ncepihom/orderpub.html.

(o) "Potential contamination source" means any facility or site which employs an activity or procedure or stores materials which may potentially contaminate ground-water or surface water. A pollution source is also a potential contamination source.

(p) "PWS" means a public water system affected by this rule, as described in R309-605-1.

(q) "Surface water" means all water which is open to the atmosphere and subject to surface runoff (see also R309-204-5(1)).

(r) "Susceptibility" means the potential for a PWS to draw water contaminated above a demonstrated background water quality concentration through any combination of the following pathways: geologic strata and overlying soil, direct discharge, overland flow, upgradient water, cracks/fissures in or open areas of the surface water intake and/or the pipe/conveyance between the intake and the water distribution system. Susceptibility is determined at the point immediately preceding treatment or, if no treatment is provided, at the entry point to the system.

(s) "Watershed" means the topographic boundary, up to the state's border, that is the perimeter of the catchment basin that provides water to the intake structure.

## *R309-605-4. Implementation.*

(1) Existing Surface Water Sources - Each PWS shall submit a Drinking Water Source Protection (DWSP) Plan to the Division of Drinking Water (Division) in accordance with R309-605-7 for each of its existing surface water sources according to the following schedule.

**TABLE**
**Schedule for DWSP Plan Submittal**

| Population served by PWS | DWSP Plans due by |
|---|---|
| Greater than 10,000 | December 31, 2001 |
| 3,300 to 10,000 | May 6, 2002 |
| Fewer than 3,300 | May 6, 2003 |

(2) New surface water sources - Each PWS shall submit a Preliminary Evaluation Report (PER) in accordance with R309-605-9 for each of its new surface water sources to the Executive Secretary.

## *R309-605-5. Exceptions.*

(1) Exceptions to the requirements of R309-605 or parts thereof may be granted by the Executive Secretary to a PWS if, due to compelling factors (which may include economic factors), a PWS is unable to comply with these requirements, and the granting of an exception will not result in an unreasonable risk to health.

(2) The Executive Secretary may prescribe a schedule by which the PWS must come into compliance with the requirements of R309-605.

## *R309-605-6. Designated Person.*

(1) Each PWS shall designate a person responsible for demonstrating the PWS's compliance with these rules. A designated person shall be appointed and reported in writing to the Executive Secretary by each PWS within 180 days of the effective date of R309-605. The name, address and telephone number of the designated person shall be included in each DWSP Plan and PER that is submitted to the Executive Secretary, and in all other correspondence with the Division.

(2) Each PWS shall notify the Executive Secretary in writing within 30 days of any changes in the appointment of a designated person.

## *R309-605-7. Drinking Water Source Protection (DWSP) for Surface Sources.*

### (1) DWSP Plans

(a) Each PWS shall develop, submit, and implement a DWSP Plan for each of its surface water sources of drinking water.

(i) Recognizing that more than one PWS may jointly use a source from the same or nearby diversions, the Executive Secretary encourages collaboration among such PWSs with joint use of a source in the development of a DWSP plan for that source. PWSs who jointly submit an acceptable DWSP plan per R309-605-7 for one surface water source above common point(s) of diversion, will be considered to have met the requirement of R309-605-7(1)(a). The deadline from R309-605-4(1) that would apply to such a collaboration would be associated with the largest population served by the individual parties to the agreement.

(b) Required Sections for DWSP Plans - DWSP Plans should be developed in accordance with the "Standard Report Format for Surface Sources". This document may be obtained from the Division. DWSP Plans must include the following eight sections:

(i) DWSP Delineation Report - A DWSP Delineation Report in accordance with R309-605-7(3) is the first section of a DWSP Plan.

(ii) Susceptibility Analysis and Determination - A susceptibility analysis and determination in accordance with R309-605-7(4) is the second section of a DWSP report.

(iii) Management Program to Control Each Preexisting Potential Contamination Source - Land management strategies to control each not adequately controlled preexisting potential contamination source in accordance with R309-605-7(5) is the third section of a DWSP Plan.

(iv) Management Program to Control or Prohibit Future Potential Contamination Sources - Land management strategies for controlling or prohibiting future potential contamination sources is the fourth section of a DWSP Plan. This must be in accordance with R309-605-7(6), must be consistent with the general provisions of this rule, and implemented to an extent allowed under the PWS's authority and jurisdiction.

(v) Implementation Schedule - The implementation schedule is the fifth section of a DWSP Plan. Each PWS shall develop a step-by-step implementation schedule which lists each of its proposed land management strategies with an implementation date for each strategy.

(vi) Resource Evaluation - The resource evaluation is the sixth section of a DWSP Plan. Each PWS shall assess the financial and other resources which may be required for it to implement each of its DWSP Plans and determine how these resources may be acquired.

(vii) Recordkeeping - Recordkeeping is the seventh section of a DWSP Plan. Each PWS shall document changes in each of its DWSP Plans as they are updated to show significant changes in conditions in the protection zones. As a DWSP Plan is executed, the PWS shall document any land management strategies that are implemented. These documents may include any of the following: ordinances, codes, permits, memoranda of understanding, public education programs, and so forth.

(viii) Public Notification - A method for, schedule for and example of the means for notifying the public water system's customers and consumers regarding the drinking water source water assessment and the results of that assessment is the last section of a DWSP plan. This must be in accordance with R309-605-7(7).

(ix) Existing watershed or resource management plans - In lieu of some or all of the report sections described in R309-605-7(1)(b), the PWS may submit watershed or resource management plans that in whole or in part meet the requirements of this rule. Such plans shall be submitted to the Executive Secretary with a cover letter that fully explains how they meet the requirements of the current DWSP rules. Any required section described in R309-605-7(1)(b) that is not covered by the watershed or resource management plan must be addressed and submitted jointly. The watershed or resource management plans will be subject to the same review and approval process as any other section of the DWSP plan.

(c) DWSP Plan Administration - DWSP Plans shall be submitted, corrected, retained, implemented, updated, and revised according to the following:

(i) Submitting DWSP Plans - Each PWS shall submit a DWSP Plan to the Executive Secretary in accordance with the schedule in R309-605-4(2) for each of its surface water sources of drinking water (a joint development and submittal of a DWSP plan is acceptable for PWSs with the joint use of a source, per R309-605-7(1)(a)(i).)

(ii) Correcting Deficiencies - Each PWS shall correct any deficiencies in a disapproved DWSP Plan and resubmit it to the Executive Secretary within 90 days of the disapproval date.

(iii) Retaining DWSP Plans - Each PWS shall retain on its premises a current copy of each of its DWSP Plans. DWSP Plans shall be made available to the public upon request.

(iv) Implementing DWSP Plans - Each PWS shall begin implementing each of its DWSP Plans in accordance with its schedule in R309-605-7(1)(b)(v), within 180 days after submittal if they are not disapproved by the Executive Secretary.

(v) Updating and Resubmitting DWSP Plans - Each PWS shall review and update its DWSP Plans as often as necessary to ensure that they show current conditions in the DWSP zones, but at least annually after the original due date (see R309-605-4(1)). Updated plans also document the implementation of land management strategies in the recordkeeping section. Updated DWSP Plans will be resubmitted to the Executive Secretary every six years from their original due date, which is described in R309-605-4.

(vi) Revising DWSP Plans - Each PWS shall submit a revised DWSP Plan to the Executive Secretary within 180 days after the reconstruction or redevelopment of any surface water source of drinking water which causes changes in source construction, source development, hydrogeology, delineation, potential contamination sources, or proposed land management strategies.

## (2) DWSP Plan Review.

(a) The Executive Secretary shall review each DWSP Plan submitted by PWSs and "concur," "conditionally concur" or "disapprove" the plan.

(b) The Executive Secretary may "disapprove" DWSP Plans for good cause, including any of the following reasons:

(i) A DWSP Plan that is missing the delineation report or any of the information and data required in it (refer to R309-605-7(3));

(ii) An inaccurate Susceptibility Analysis or a DWSP Plan that is missing this report or any of the information required in it (refer to R309-605-7(4));

(iii) An inaccurate Prioritized Inventory of Potential Contamination Sources or a DWSP Plan that is missing this report or any of the information required in it (refer to R309-605-7(4)(c));

(iv) An inaccurate assessment of current controls (refer to R309-605-7(4)(a)(iii)(B));

(v) A missing or incomplete Management Program to Control Each Preexisting Potential Contamination Source which has been assessed as "not adequately controlled" by the PWS (refer to R309-605-7(5));

(vi) A missing or incomplete Management Program to Control or Prohibit Future Potential Contamination Sources (refer to R309-605-7(6));

(vii) A missing Implementation Schedule, Resource Evaluation, Recordkeeping Section, or Contingency Plan (refer to R309-605-7(1)(b)(v-vii) and R309-605-9);

(viii) A missing or incomplete Public Notification Section (refer to R309-605-7(7).

(c) If the Executive Secretary conditionally concurs with a DWSP Plan, the PWS must implement the conditions and report compliance the next time the DWSP Plan is due and submitted to the Executive Secretary.

## (3) Delineation of Protection Zones

(a) The delineation section of the DWSP plan for surface water sources may be obtained from the Division upon request. A delineation section prepared and provided by the Division would become the first section of the submittal from the PWS. The delineation section provided by the Division will consist of a map or maps showing the limits of the zones described in R309-605-7(3)(b)(i-iv), and will include an inventory of potential contamination sources on record in the Division's Geographic Information System.

(b) Alternatively, the PWS may provide their own delineation report. Such a submittal must either describe the zones as defined in R309-605-7(3)(b)(i-iv), or must comply with the requirements and definitions of R309-605-7(3)(c). The delineation report must include a map or maps showing the extent of the zones.

(i) Zone 1:

(A) Streams, rivers and canals: zone 1 encompasses the area on both sides of the source, 1/2 mile on each side measured laterally from the high water mark of the source (bank full), and from 100

feet downstream of the POD to 15 miles upstream, or to the limits of the watershed or to the state line, whichever comes first. If a natural stream or river is diverted into an uncovered canal or aqueduct for the purpose of delivering water to a system or a water treatment facility, that entire canal will be considered to be part of zone 1, and the 15 mile measurement upstream will apply to the stream or river contributing water to the system from the diversion.

(B) Reservoirs or lakes: zone 1 is considered to be the area 1/2 mile from the high water mark of the source. Any stream or river contributing to the lake/reservoir will be included in zone 1 for a distance of 15 miles upstream, and 1/2 mile laterally on both sides of the source. If a reservoir is diverted into an uncovered canal or aqueduct for the purpose of delivering water to a system or a water treatment facility, that entire canal will be considered to be part of zone 1, and the 15 mile measurement upstream will apply to the reservoir and tributaries contributing water to the system.

(ii) Zone 2: Zone 2 is defined as the area from the end of zone 1, and an additional 50 miles upstream (or to the limits of the watershed or to the state line, whichever comes first), and 1000 feet on each side measured from the high water mark of the source.

(iii) Zone 3: Zone 3 is defined as the area from the end of zone 2 to the limits of the watershed or to the state line, whichever comes first, and 500 feet on each side measured from the high water mark of the source.

(iv) Zone 4: Zone 4 is defined as the remainder of the area of the watershed (up to the state line, if applicable) contributing to the source that does not fall within the boundaries of zones 1 through 3.

(v) Special case delineations:

(A) Basin Transfer PODs: Where water supplies are received from basin transfers, the water from the extraneous basin will be treated as a separate source, and will be subject to its own DWSP plan, starting from zone 1 at the secondary POD.

(c) If the PWS is able to demonstrate that a different zone configuration is more protective than those defined in R309-605-7(3)(b), that different configuration may be used upon prior review and approval by the Executive Secretary. An explanation of the method used to obtain and establish the dimensions of the zones must be provided. The delineation report must include a map or maps showing the extent of the zones. The entire watershed boundary contributing to a source must be included in the delineation.

## (4) Susceptibility Analysis and Determination:

(a) Susceptibility Analysis:

(i) Structural integrity of the intake: The PWS will evaluate the structural integrity of the intake to ensure compliance with the existing source development rule (R309-204-5) on a pass or fail basis. The pass-fail rating will be determined by whether the intake meets minimum rule requirements, and whether the physical condition of the intake is adequate to protect the intake from contamination events. The integrity evaluation includes any portion of the conveyance from the point of diversion to the distribution systems that is open to the atmosphere or is otherwise vulnerable to contamination, including distribution canals, etc.

(ii) Sensitivity of Natural Setting: The PWS will evaluate the sensitivity of the source based on physiographic and/or hydrogeologic factors. Factors influencing sensitivity may include any natural or man-made feature that increases or decreases the likelihood of contamination. Sensitivity does not address the question of whether contamination is present in the watershed or recharge area.

(iii) Assessment of management of potential contamination sources:

(A) Potential Contamination Source Inventory

(I) Each PWS shall identify and list all potential contamination sources within DWSP zones 1, 2 and 3, as applicable for individual sources. The name and address of each non-residential potential contamination source is required, as well as a list of the chemical, biological, and/or radiological hazards associated with each potential contamination source. Additionally, each PWS shall identify each potential contamination source as to its location in zone one, two, or three and plot it on the map required in R309-605-7(3)(a and b). The PWS may rely on the inventory provided by the Division for zone 4.

(II) List of Potential Contamination Sources - A List of Potential Contamination Sources may be obtained from the Division. This list may be used by PWSs as an introduction to inventorying potential contamination sources within their DWSP zones. The list is not intended to be all-inclusive.

(III) Refining, Expanding, Updating, and Verifying Potential Contamination Sources - Each PWS shall update

its list of potential contamination sources to show current conditions within DWSP zones according to R309-605-7(1)(c)(v). This includes adding potential contamination sources which have moved into DWSP zones, deleting potential contamination sources which have moved out, improving available data about potential contamination sources, and all other appropriate refinements.

(B) Identification and Assessment of Controls: The PWS will identify and assess the hazards at each potential contamination source, including those in the inventory provided by the Division that are located in zone 4, as "adequately controlled" or "not adequately controlled".

(I) If controls are not identified, the potential contamination source will be considered "not adequately controlled." Additionally, if the hazards at a potential contamination source cannot be or are not identified, the potential contamination source must be assessed as "not adequately controlled."

(II) Types of controls: For each hazard deemed to be controlled, one of the following controls shall be identified: regulatory, best management/pollution prevention, or physical controls. Negligible quantities of contaminants are also considered a control. The assessment of controls will not be considered complete unless the controls are completely evaluated and discussed in the DWSP report, using the following criteria:

Regulatory Controls - Identify the enforcement agency and verify that the hazard is being regulated by them; cite and/or quote applicable references in the regulation, rule or ordinance which pertain to controlling the hazard; explain how the regulatory controls affect the potential for surface water contamination; assess the hazard; and set a date to reassess the hazard. For assistance in identifying regulatory controls, refer to the "Source Protection User's Guide" Appendix D for a list of government agencies and the programs they administer to control potential contamination sources. This guide may be obtained from the Division.

Best Management/Pollution Prevention Practice Controls - List the specific best management/pollution prevention practices which have been implemented by potential

contamination source management to control the hazard and indicate that they are willing to continue the use of these practices; explain how these practices affect the potential for surface water contamination; assess the hazard; and set a date to reassess the hazard.

Physical Controls - Describe the physical control(s) which have been constructed to control the hazard; explain how these controls affect the potential for contamination; assess the hazard; and set a date to reassess the hazard.

Negligible Quantity Control - Identify the quantity of the hazard that is being used, disposed, stored, manufactured, and/or transported; explain why this amount is a negligible quantity; assess the hazard; and set a date to reassess the hazard.

(III) PWSs may assess controls on PCSs collectively, when the PCSs have similar characteristics, or when the PCSs are clustered geographically. Examples may include, but are not limited to, abandoned mines that are part of the same mining districts, underground storage tanks that are in the same zone, or leaking underground storage tanks in the same city. However, care should be taken to avoid collectively assessing PCSs to the extent that the assessments become meaningless. The Executive Secretary may require an individual assessment for a PCS if the Executive Secretary determines that the collective assessment does not adequately assess controls.

(C) A potential contamination source which is covered by a permit or approval under one of the regulatory programs listed below shall be considered to be adequately controlled unless otherwise determined by the Executive Secretary. The PWS must provide documentation establishing that the PCS is covered by the regulatory program. For all other state regulatory programs, the PWS's assessment is subject to review by the Executive Secretary; as a result, a PWS's DWSP Plan may be disapproved if the Executive Secretary does not concur with its assessment(s).

(I) The Utah Ground-Water Quality Protection program established by Section 19-5-104 and Rule R317-6;

(II) Closure plans or Part B permits under authority of the Resource Conservation and Recovery Act (RCRA) of 1984 regarding the monitoring and treatment of ground-water;

(III) The Utah Pollutant Discharge Elimination System (UPDES) established by Section 19-5-104 and Rule R317-8; at the discretion of the PWS, this may include Confined Animal feeding Operations/Animal Feeding Operations (CAFO/AFO) assessed under the Utah DWQ CAFO/AFO Strategy.

(IV) The Underground Storage Tank Program established by Section 19-6-403 and Rules R311-200 through R311-208; and

(V) the Underground Injection Control (UIC) Program for classes I-IV established by Sections 19-5-104 and 40-6-5 and Rules R317-7 and R649-5.

(b) Susceptibility determination:

(i) The PWS will assess the drinking water source for its susceptibility relative to each potential contamination source. The determination will be based on the following four factors: 1) the structural integrity of the intake, 2) the sensitivity of the natural setting, 3) whether a PCS is considered controlled or not, and 4) how the first three factors are interrelated. The PWS will provide an explanation of the method or judgement used to weigh the first three factors against each other to determine susceptibility.

(ii) Additionally, each drinking water source will be assessed by the PWS for its overall susceptibility to potential contamination events. This will result in a qualitative assessment of the susceptibility of the drinking water source to contamination. This assessment of overall susceptibility allows the PWS and others to compare the susceptibility of one drinking water source to another.

(iii) Each surface water drinking water source in the state of Utah is initially considered to have a high susceptibility to contamination, due to the intrinsic unprotected nature of surface water sources. An assumption of high susceptibility will be used by the Executive Secretary unless a PWS or a group of PWSs demonstrates otherwise, per R309-605, and receives concurrence from the Executive Secretary under R309-605-7(2).

(c) Prioritized Potential Contamination Source Inventory: The PWS will prepare a prioritized inventory of potential contamination sources based on the susceptibility determinations in R309-605-7(4)(b)(i). The inventory will rank potential contamination sources based on the degree of threat posed to the drinking water source as determined in R309-605-7(4)(b)(i).

## (5) Management Program to Control Each Preexisting Potential Contamination Source.

(a) PWSs are not required to plan and implement land management strategies for potential contamination source hazards that are assessed as "adequately controlled."

(b) With the first submittal of the DWSP Plan, PWSs shall include management strategies to reduce the risk of contamination from, at a minimum, each of the three highest priority uncontrolled Potential Contamination Sources in the protection zones for the source. The Executive Secretary may require land management strategies for additional Potential Contamination Sources to assure adequate protection of the source. A management plan may be for one specific Potential Contamination Source (i.e., a sewage lagoon discharging into a stream), or for a group of similar or related Potential Contamination Sources that were assessed jointly under R309-605-7(4)(a)(iii)(B)(III) (i.e., one management plan for septic systems within one residential devlopment would be acceptable, and would count as one of the three Potential Contamination Source management strategies.)

PWSs shall plan land management strategies to control preexisting uncontrolled potential contamination sources in accordance with their existing authority and jurisdiction. Land management strategies must be consistent with the provisions of R309-605, designed to control or reduce the risk of potential contamination, and may be regulatory or non-regulatory. Land management strategies must be implemented according to the schedule required in R309-605-7(1)(b)(v).

(c) PWSs with overlapping protection zones may cooperate in controlling a particular preexisting potential contamination source if one PWS will agree to take the lead in planning and implementing land management strategies. The remaining PWS(s) will assess the preexisting potential contamination source as "adequately controlled."

(d) At each six year cycle for revising and resubmitting the DWSP Plan, under the schedule in R309-605-7(1)(c)(v), the PWS shall prioritize their inventory again, and shall propose a management program to control preexisting PCSs for the three highest priority PCSs, which may include uncontrolled PCSs not previously managed. The PWS shall also continue existing management programs, unless justification is provided that demonstrates that a PCS that was previously managed is now considered controlled.

## (6) Management Program to Control or Prohibit Future Potential Contamination Sources for Existing Drinking Water Sources.

(a) PWSs shall plan land management strategies to control or prohibit future potential contamination sources within each of its DWSP zones consistent with the provisions of R309-605 and to the extent allowed under its authority and jurisdiction. Land management strategies must be designed to control or reduce the risk of potential contamination and may be regulatory or non-regulatory. Additionally land management strategies must be implemented according to the schedule required in R309-605-7(1)(b)(v).

(b) Protection areas may extend into neighboring cities, towns, and counties. Since it may not be possible for some PWSs to enact regulatory land management strategies outside of their jurisdiction, except for municipalities as described below, it is recommended that these PWSs contact their neighboring cities, towns, and counties to see if they are willing to implement protective ordinances to prevent surface water contamination under joint management agreements.

(c) Cities and towns have extraterritorial jurisdiction in accordance with Section 10-8-15 of the Utah Code Annotated to enact ordinances to protect a stream or "source" from which their water is taken... " for 15 miles above the point from which it is taken and for a distance of 300 feet on each side of such stream...."

(d) Zoning ordinances are an effective means to control potential contamination sources that may want to move into protection areas. They allow PWSs to prohibit facilities that would discharge contaminants directly to surface water. They also allow PWSs to review plans from potential contamination sources to ensure there will be adequate spill protection and waste disposal procedures, etc. If zoning ordinances are not used, PWSs must establish a plan to contact potential contamination sources individually as they move into protection areas, identify and assess their controls, and plan land management strategies if they are not adequately controlled.

## (7) Public Notification:

Within their DWSP report, each PWS shall specify the method and schedule for notifying their customers and consumers that an assessment of their surface water source has been completed and what the results of that assessment are. Each PWS shall provide the proposed public notification material as an appendix to the DWSP report. The public notification material shall include a discussion of the general geologic and physical setting of the source, the sensitivity of the setting, general types of potential contamination sources in the area, how susceptible the drinking water source is to potential contamination and a map showing the location of the drinking water source and generalized areas of potential concern (it is not mandatory to show the location of the intake itself). The public notification material will be in plain English. The purpose of

this public notification is to advise the public regarding how susceptible their drinking water source is to potential contamination sources. Examples of means of notifying the public, and examples of acceptable public notification materials, are available from the Division. The public notification materials must be approved by the Executive Secretary prior to distribution.

## *R309-605-8. DWSP for Ground-Water Sources Under the Direct Influence of Surface Water Sources.*

(1) DWSP for ground-water sources under the direct influence of surface water sources will be accomplished through delineation of both the ground-water and surface water contribution areas. The requirements of R309-600 will apply to the ground-water portion, and the requirements of R309-605 will apply to the surface water portion, except that the schedule for such DWSP plans under this section will be based on the schedule shown in R309-605-4(1).

## *R309-605-9. New Surface Water Sources of Drinking Water.*

(1) Prior to constructing a new surface water source of drinking water, each PWS shall develop a preliminary evaluation report (PER) which demonstrates that the source location has been chosen such that the number of uncontrolled sources in zones 1 and 2 is minimized. If the source water is not currently classified as Class 1C under UAC R317-2, the PWS must request such a classification from the Water Quality Board for zones 1 and 2. The PWS must also request that the source water be categorized as High Quality Waters - Category 1, 2 or 3 under UAC R317-2-3 (Antidegradation Policy), if applicable. Categorization of the source will reduce (Category 3) or eliminate (Category 1 and 2) the potential for source water degradation from new pollution sources. In addition, engineering information in accordance with R309-204-4 and R309-204-5 (general source development and surface water source development requirements) must be submitted to the Executive Secretary concurrent with the PER. A complete DWSP plan is required, one year after approval of the PER and after construction of the source intake, following the requirements of R309-605-7.

(2) Preliminary Evaluation Report (PER) for New Sources of Drinking Water - PERs shall cover all four zones. PERs should be developed in accordance with the "Standard Report Format for New Surface Sources." This document may be obtained from the Division. PWSs shall include the following four sections in each PER:

(a) Delineation Report for Estimated DWSP Zones - The same requirements apply as in R309-605-7(3).

(b) Susceptibility Analysis and determination (including inventory)- The same requirements apply as in R309-605-7(4).

(c) Land Use Map - A land use map which includes all land within zones one and two and the primary use of the land (residential, commercial, industrial, recreational, crops, animal husbandry, etc). Existing maps or GIS data may be used to satisfy this requirement. the zoning ordinance to substantiate any land use restrictions.

(d) Documentation of Division of Water Quality classification of source water - with reference to R317-2, provide documentation of the classification of the source waters by the Water Quality Board/Division of Water Quality (see also R309-605-9(1)), and of any associated petition for a change in classification.

(3) DWSP Plan for New Sources of Drinking Water - The PWS shall submit a DWSP Plan in accordance with R309-605-4 for any new surface water source of drinking water within one year after the date of the Executive Secretary's concurrence letter with the PER. In developing this DWSP Plan, PWSs shall refine the information in the PER by applying any new characteristics of the source.

## *R309-605-10. Contingency Plans.*

PWSs shall submit a Contingency Plan which includes all sources of drinking water (groundwater and surface water) for their entire water system to the Executive Secretary concurrently with the submission of their first DWSP Plan. The Contingency Plan shall address emergency response, rationing, water supply decontamination, and development of alternative sources.

**KEY:**
drinking water, environmental health

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